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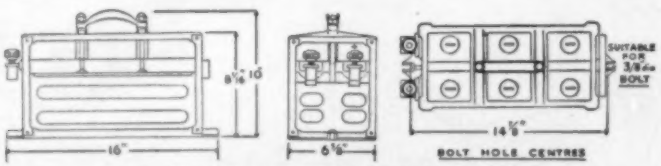

Side and end views of 6-EP19B/2 with battery layout diagram

Dagenite Aircraft Batteries

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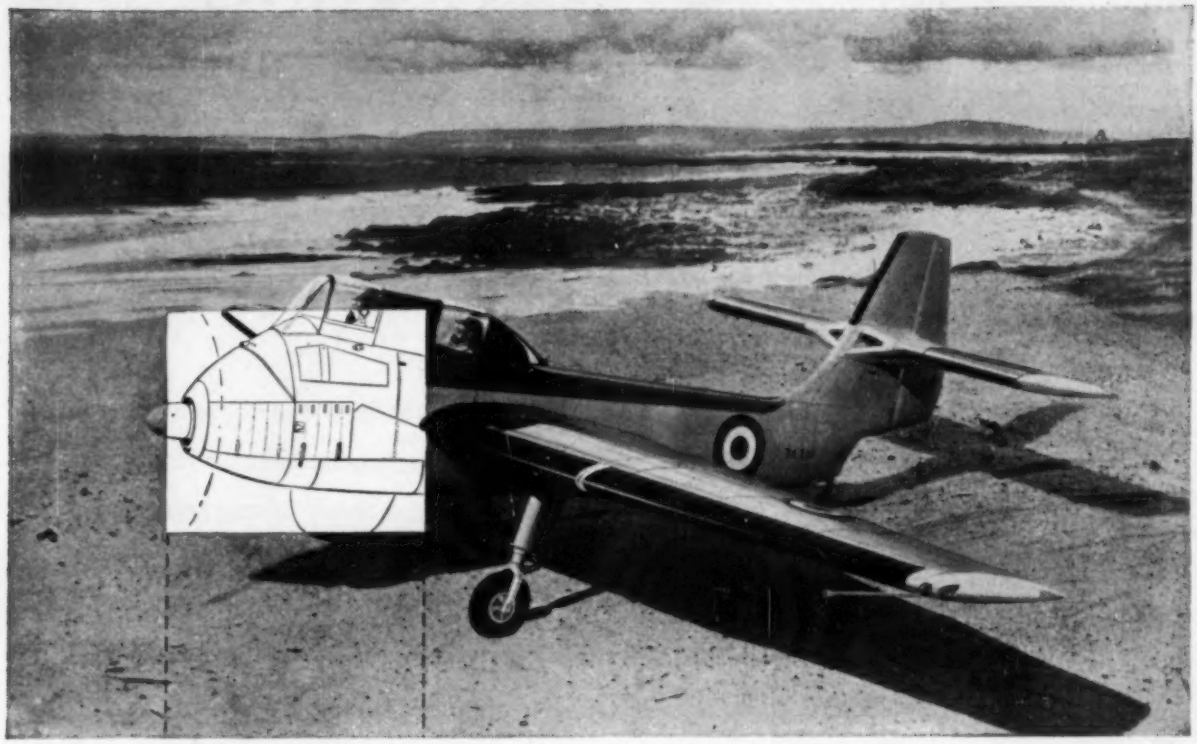
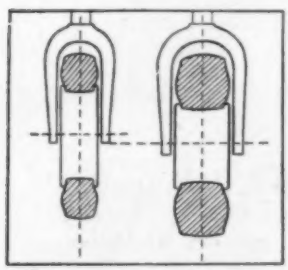
Sand strip – *Seamew* base



Simplicity of design ensures simplicity of maintenance—and economy in initial cost and in use of spares and manpower. Removable panels make components easily accessible.



The wheels of the Seamew can be swiftly changed, with differing sizes of tyre to suit the surfaces from which it operates.

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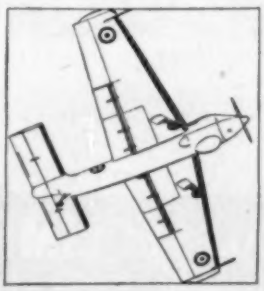

The *Short* answer is the *Seamew*

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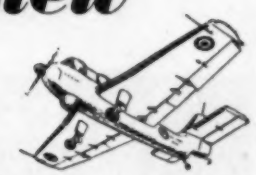

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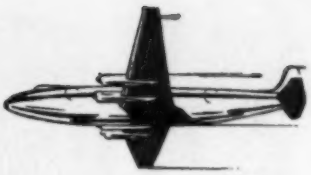

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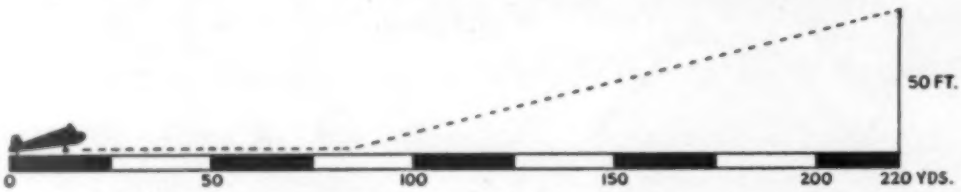

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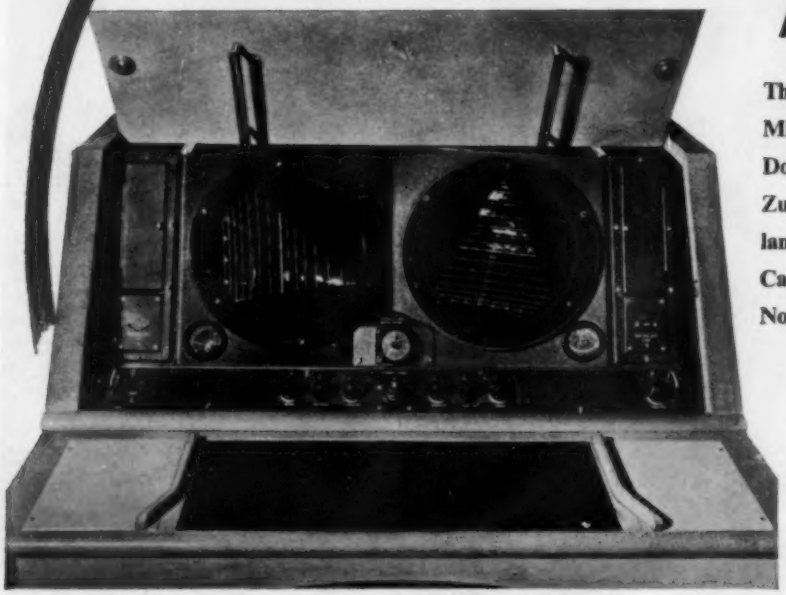

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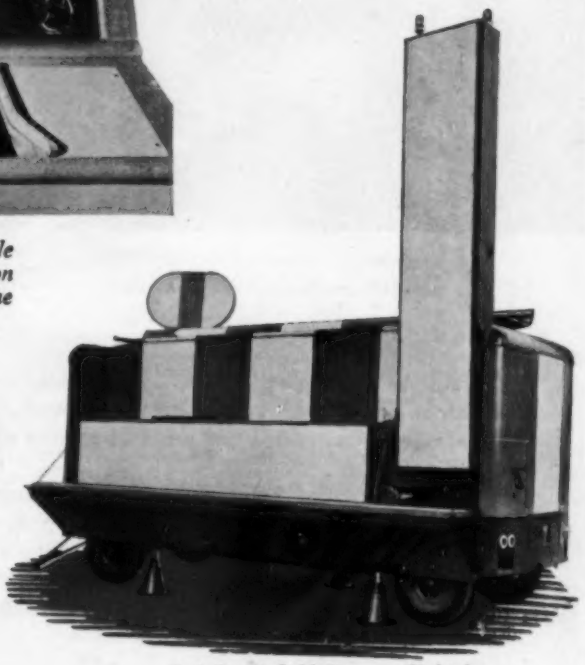

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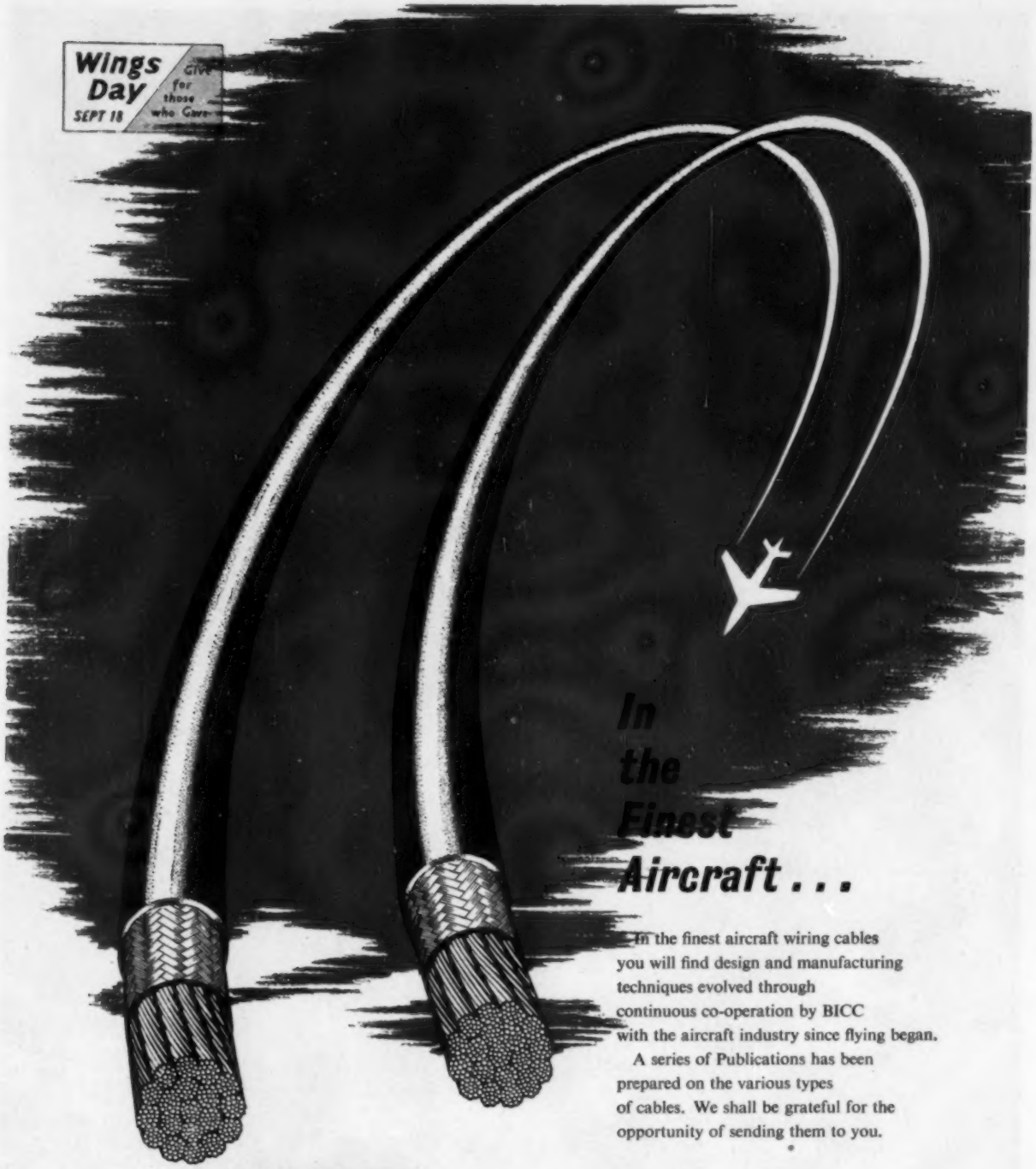

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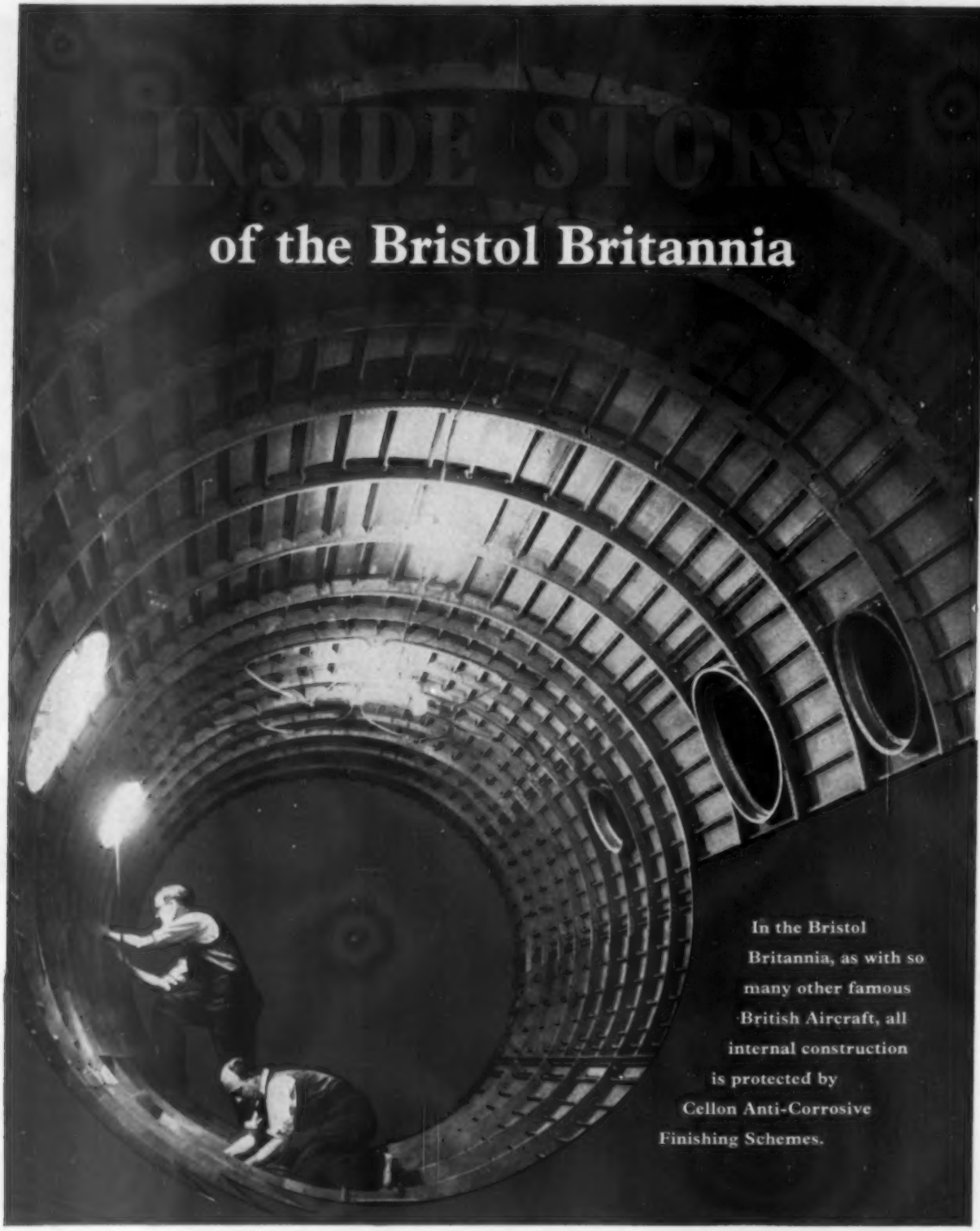

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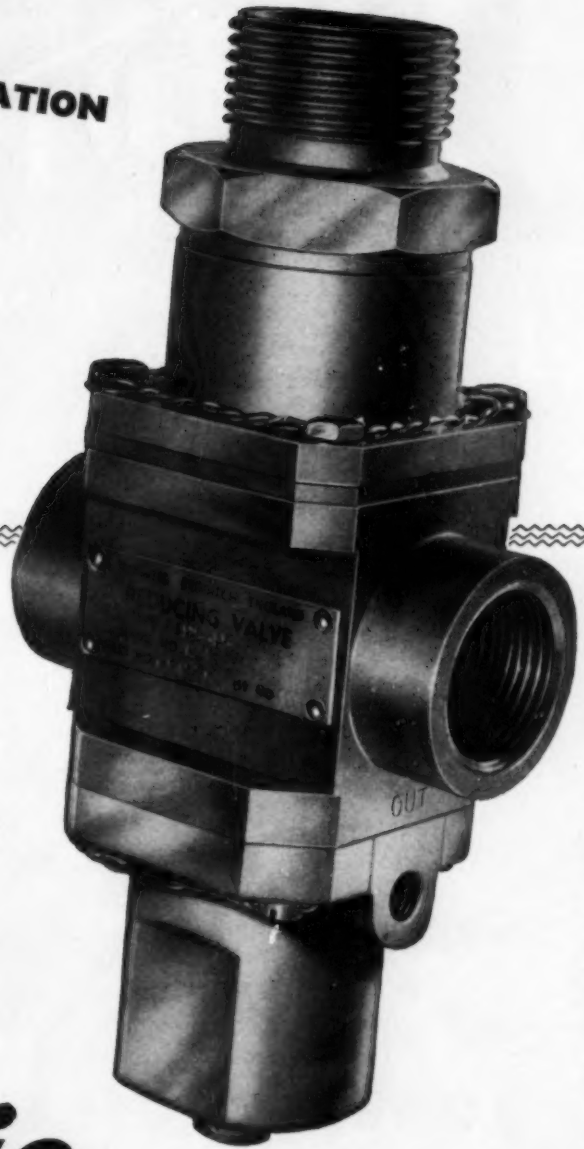

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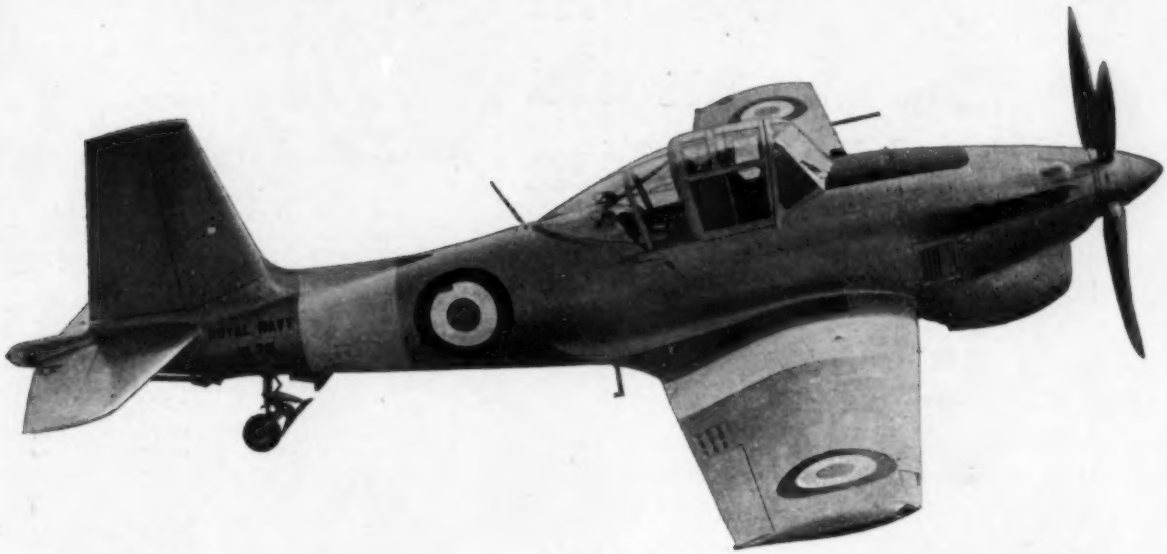

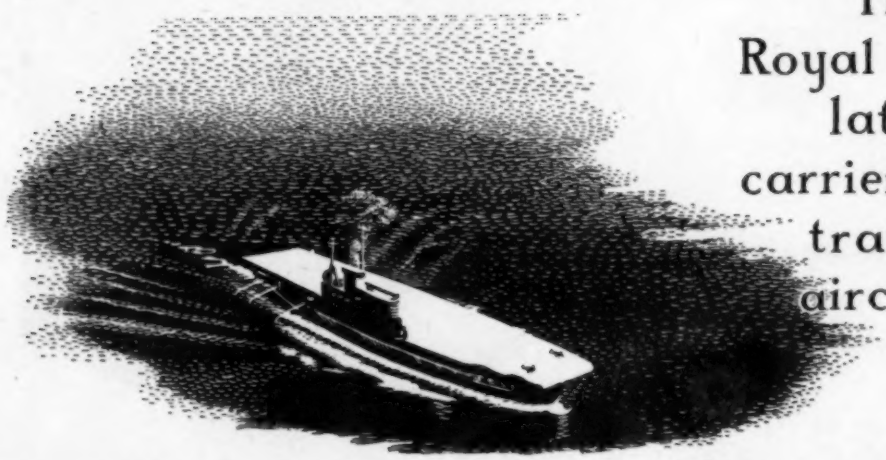

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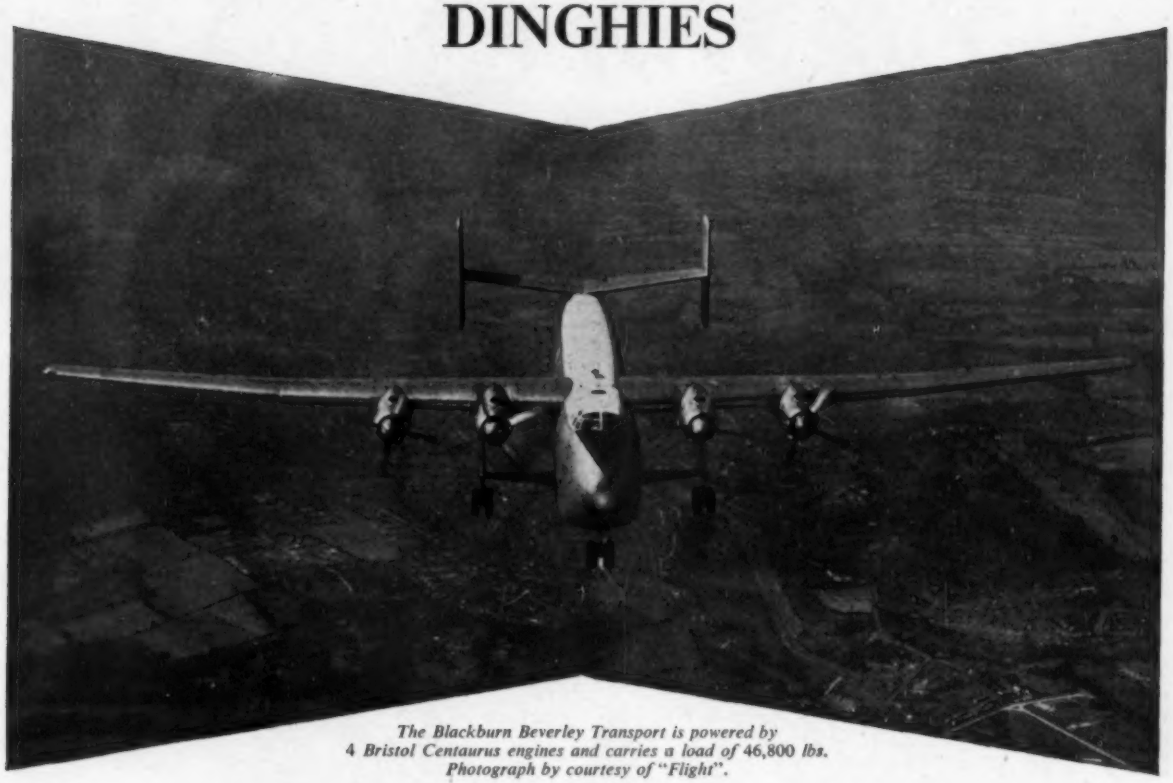

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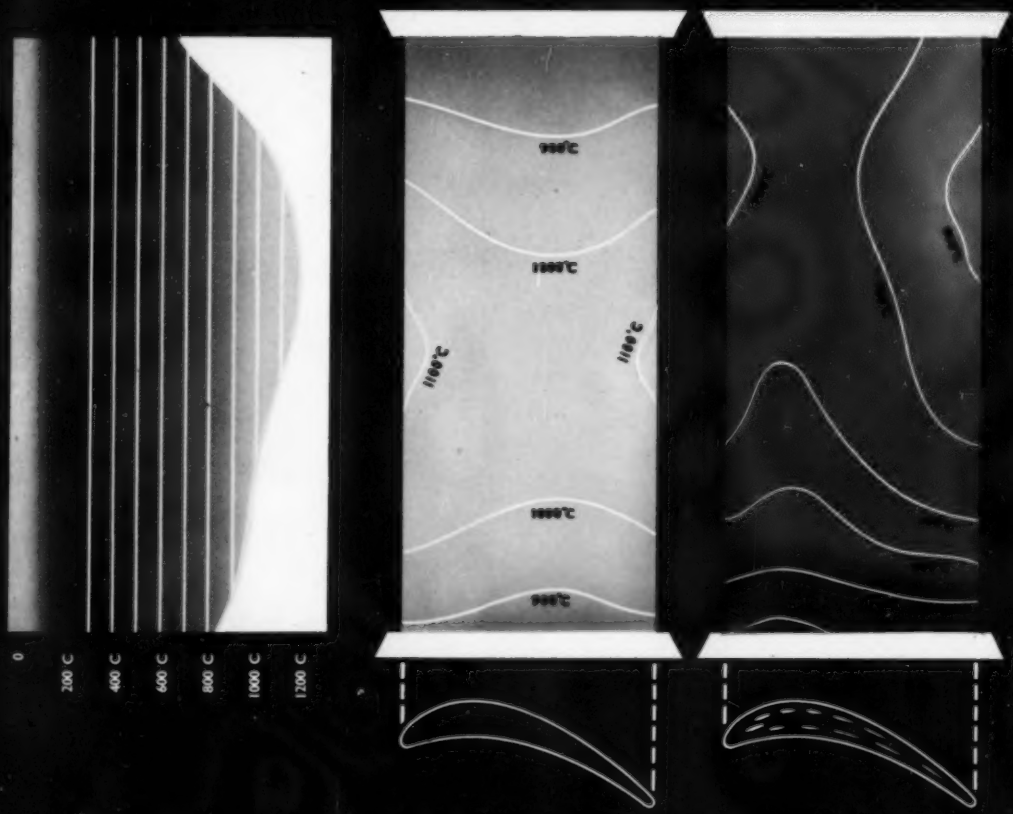

Typical temperature distribution at outlet from combustion chamber.

Resultant temperature distribution over typical solid nozzle blade.

Effect of cooling passages on nozzle blade of similar form.

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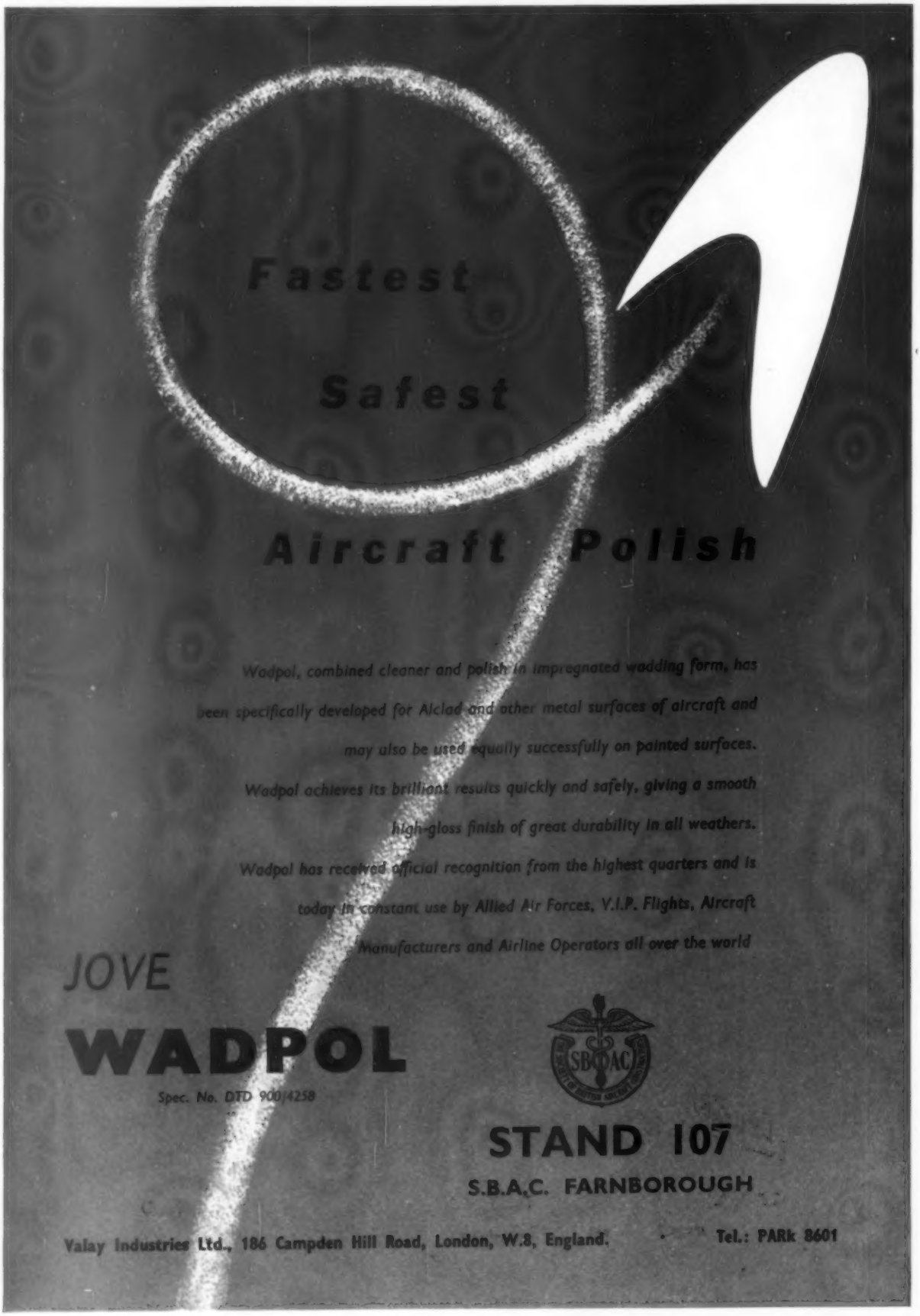
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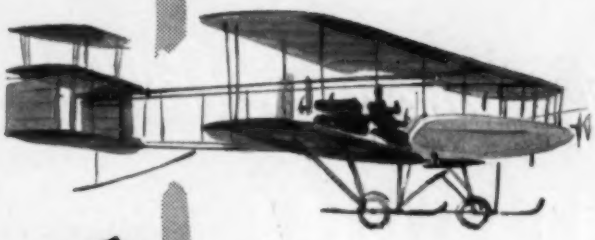

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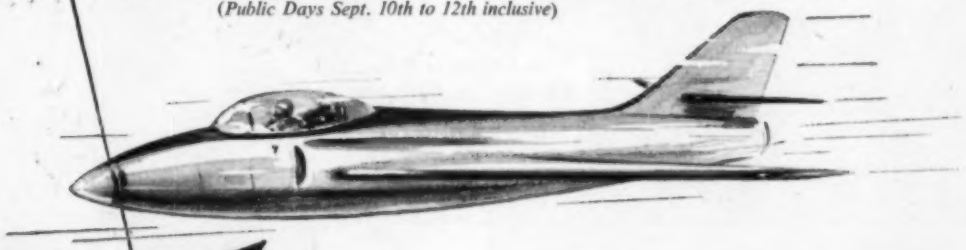

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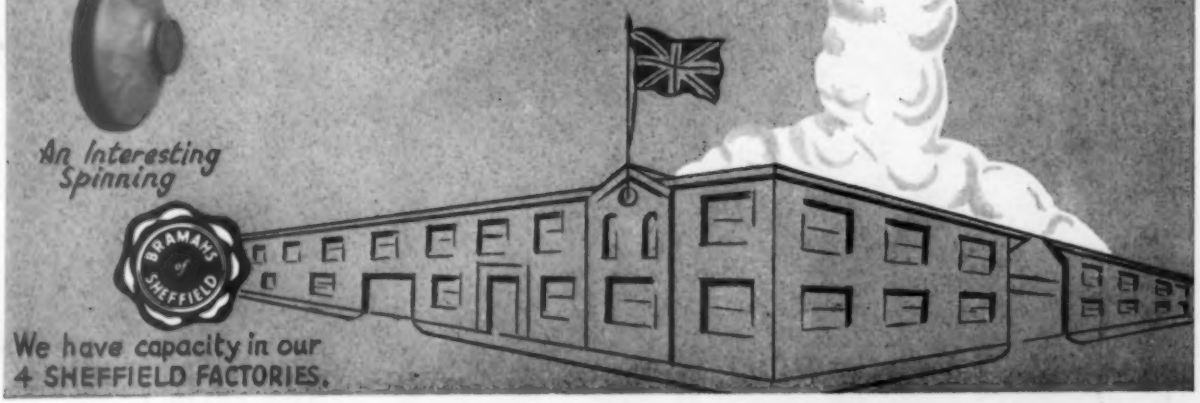

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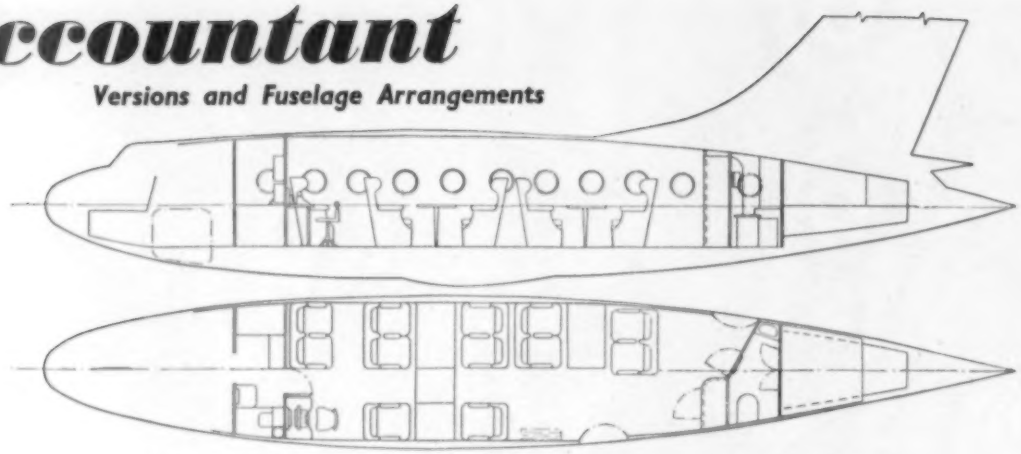

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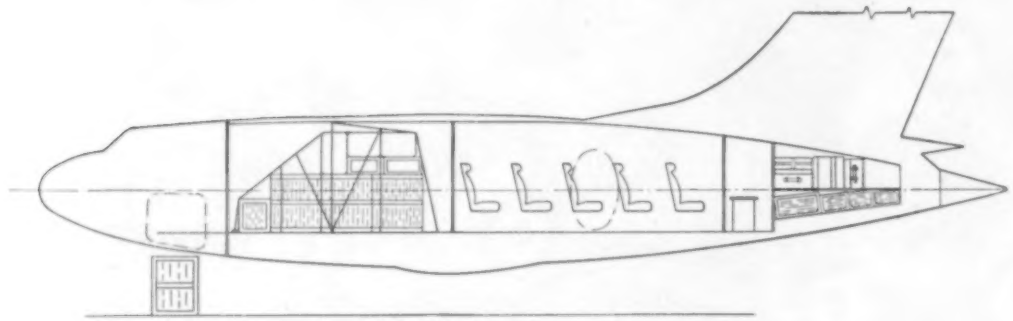
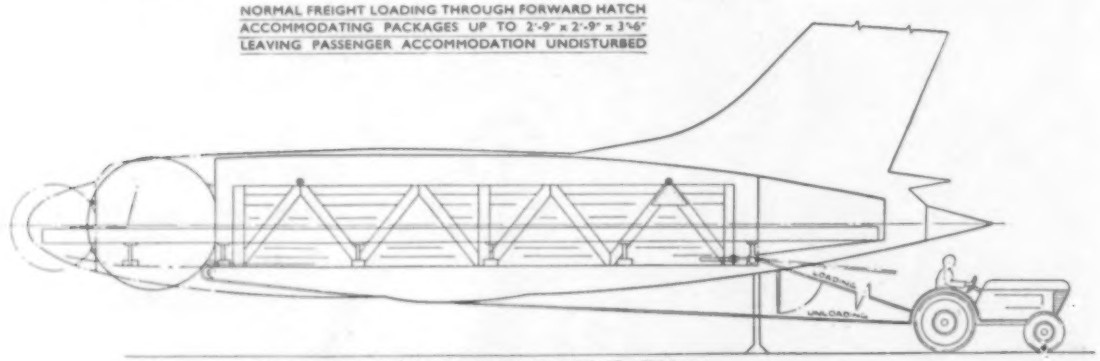
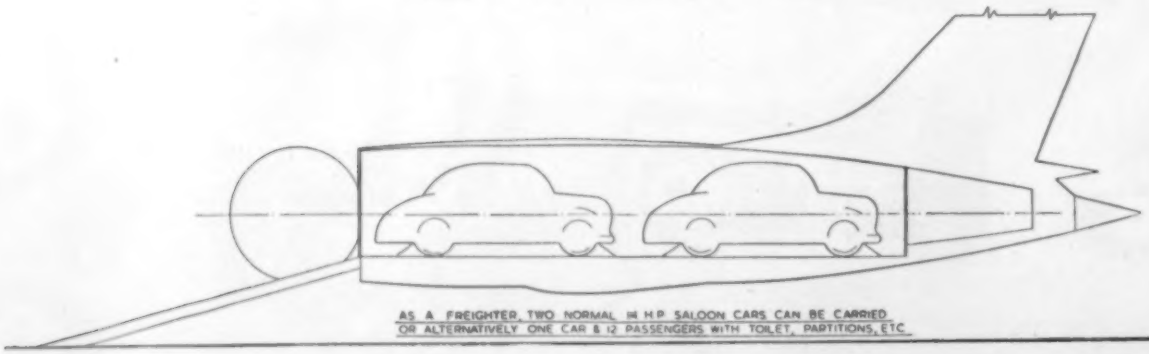


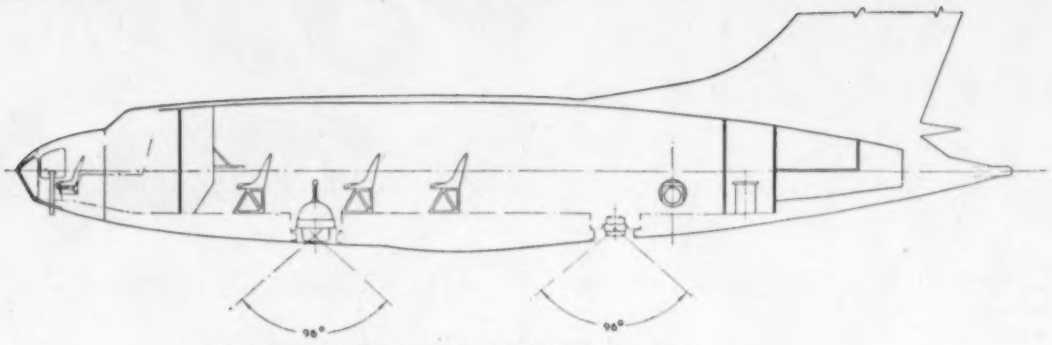
NORMAL FREIGHT LOADING THROUGH FORWARD HATCH ACCOMMODATING PACKAGES UP TO 2'-9" x 2'-9" x 3'-6" LEAVING PASSENGER ACCOMMODATION UNDISTURBED



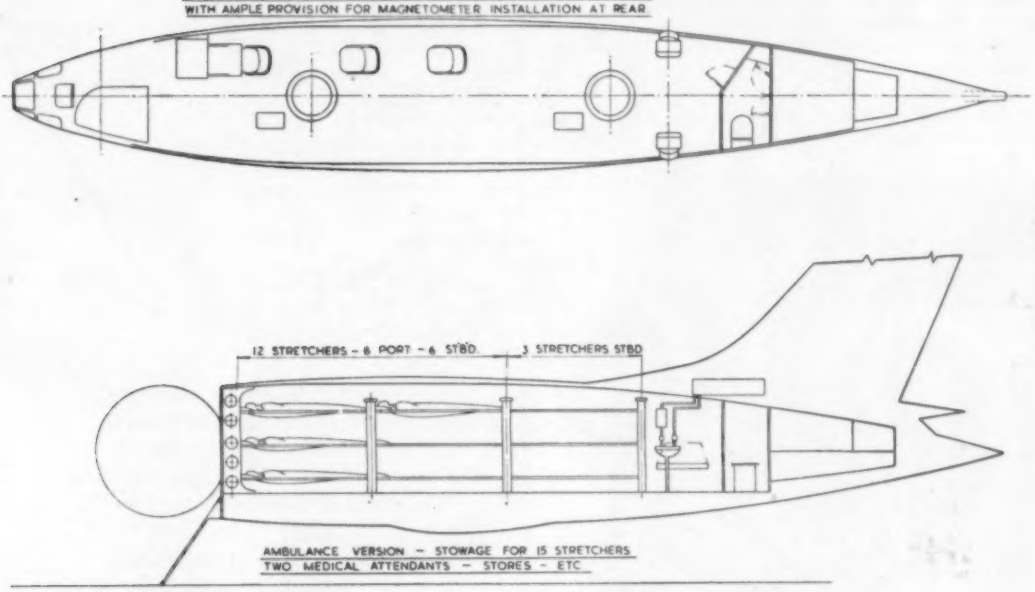
LAYOUT GIVING MAX FREIGHTER DISPOSABLE LOAD OF 11,750 lb o/v. STAGE LENGTH, WITH 200 N. MILE DIVERSION, 1/2 HOUR STANDOFF AND ALLOWANCES - 200 N. MILES A/C NON-PRESSURISED CREW OXYGEN ONLY. TYPICAL LOADS ILLUSTRATED ARE PACKING CASES UP TO 30'-0" x 4'-9" x 3'-0" or 22'-0" x 5'-6" x 4'-9" & BUNDLES UP TO 50'-0" x 9ins x 2'-0" SUITABLY SUPPORTED



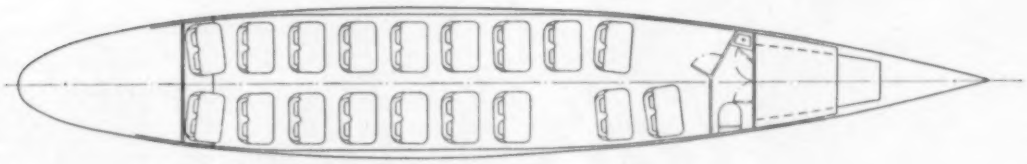
AS A FREIGHTER, TWO NORMAL 14 H.P. SALOON CARS CAN BE CARRIED OR ALTERNATIVELY ONE CAR & 12 PASSENGERS WITH TOILET, PARTITIONS, ETC.



TYPICAL LAYOUT OF AIRCRAFT EQUIPPED FOR AERIAL SURVEY WORK WITH PROVISION FOR A WIDE RANGE OF OBLIQUE OR VERTICAL CAMERAS & NAVIGATOR, WIRELESS OPERATOR, & TWO CAMERA OPERATORS, WITH AMPLE PROVISION FOR MAGNETOMETER INSTALLATION AT REAR



AMBULANCE VERSION - STOWAGE FOR 15 STRETCHERS TWO MEDICAL ATTENDANTS - STORES - ETC



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IN THIS ISSUE:

The Show: Aircraft and Demonstrations Described 398
The Display Pilots - - 409
Transports in Prospect - 412
Vertical Take-off - - - 416
Agricultural Control by Air 420
Aircraft to Weapons System 423

The Show is On

DURING the next three days more people are expected to assemble at Farnborough to see the S.B.A.C. Flying Display and Exhibition than have ever before attended an aviation meeting in this country. Last year, in fine weather, the total public attendance was over 201,000; this week-end, with the promise of superb flying demonstrations by the country's most skilful pilots at the controls of the newest and most exciting aircraft, it will take more than showers to keep away even larger numbers of enthusiasts. Accordingly, a few words about the whys and wherefores of the S.B.A.C. Show (and a note or two on our own activities to mark the occasion) will not be out of place at this time—the week of the fifteenth such event.

Since the war, this first week in September has become a great time for aviation. The first S.B.A.C. Display was held at Hendon in 1932, and last Wednesday's display was the fiftieth separate day's flying programme to be so staged by the Society of British Aircraft Constructors. *Flight's* task at show time is first to provide each year an up-to-date guide to the products of the ever-expanding British aircraft industry. This we did in last week's issue, which was timed to be available as a buyer's guide to more than 5,000 official guests representing 93 different countries, and to well over 50,000 other readers at home and abroad.

This year, for the first time, *Flight* has also published a special number to describe the work of the Commonwealth aircraft industries. These manufacturers are rapidly increasing in numbers and importance, and many of them are closely linked with British parent or associate firms. No longer can a true picture of productive capacity be obtained by thinking only of the home industry; it is necessary now to consider also the Canadian and Australian companies. As we remarked a fortnight ago, this is British productive strength in depth.

Sometimes the question is asked: "Why are the general public not allowed into the show every day?" The answer is that, unlike the car or motor-cycle shows at Earls Court, the S.B.A.C. Exhibition is organized first and foremost for the overseas buyer; and he, having spent time and money to visit our country, must be accorded special attention. Overseas orders are not only of the utmost importance to the country but are also vital to our aircraft industry. Without them, and dependent only upon home orders, this great manufacturing potential could not be maintained. Such aircraft as were produced would almost certainly be more expensive to purchase and slower in appearing.

There is a second very important contribution which the S.B.A.C. Show makes each year, namely, the provision of an opportunity for the men in the industry to see for themselves what progress the other companies have made, what methods they employ, and what new materials and equipment are available. This is extremely valuable; most people will know how easy it is to become absorbed in one's own work to the exclusion of almost everything else. Frankly, we who are lucky to have almost unique opportunities to study the work of the industry as a whole have noted at times a surprising lack of knowledge (and even interest) on the part of one firm concerning the work of another. We believe that every man who can be spared for a day should be not only enabled but encouraged to visit the Farnborough Show.

Finally, what of the great public, who are no less important for being mentioned and catered for last? It is ultimately their opinions and their money which make possible the fleets of civil and military aircraft that serve this nation. Their support and enthusiasm is another ingredient essential to the motive force of the British aircraft industry.

The public who visit Farnborough are not concerned with every product displayed there; nor, as a rule, do they wish to dig into all the details. In the main they love speed, and they like to feel pride in fine British aircraft and thrill to their displays in the great arena overhead. There are some, of course, who have a very personal interest, for among the tens of thousands are the families of the test pilots, of the designers and of the men who make the aircraft. For our own part, our day-to-day work is closely concerned with these aircraft, and our respect for the men who design, make and fly them—and for the machines themselves—steadily increases. In the pages that follow are recorded, for the edification of all our readers, the highlights of the British aircraft of 1954 and of their flying demonstrations as seen by us during the opening days earlier this week.

FROM ALL QUARTERS

"Positive" Results of Comet Investigations

IN response to what he believed to be "the general desire that something further should be said about the Comet investigation before the British aviation show opens at Farnborough next week," Mr. Duncan Sandys, Minister of Supply, made a statement on Saturday last.

Though he went into no technical details, his remarks showed that the investigations had "yielded clear and positive results." These results indicated, he said, "that some strengthening of certain parts of the structure of the Comet is necessary. I am advised that the introduction of these changes is entirely practicable and should not involve any fundamental redesign . . .

"It is intended as soon as possible to modify the Comet in this way and to test it out at Farnborough. We must necessarily reserve final opinion about future prospects until these further tests have been carried out and the conclusions of the Court of Inquiry are known. However, the extensive information already available gives every reason for confidence that it will be possible to make the Comet safe and satisfactory and to resume production before very long."

The Court of Inquiry referred to by Mr. Sandys will be convened on or about October 19th. Earlier in his statement the Minister had referred to the recovery of G—ALYP off Elba and to the investigations carried out by the R.A.E. and de Havillands. He referred to the three main tasks involved in the investigation —piecing together innumerable fragments of wreckage and examining them for "every scratch or dent"; a carefully planned programme of test flying on Comets fitted with a variety of recording instruments; and fatigue testing of the airframe.

Rolls-Royce V.T.O.

AS recorded on page 408, the Minister of Supply, Mr. Duncan Sandys, in his speech at the S.B.A.C. Dinner revealed not only the existence of a British vertical take-off machine but also the fact that it had risen in controlled free flight. Subsequently the following additional information appeared in reports.

Nicknamed by Lord Hives "the flying bedstead", this experimental machine is understood to comprise a four-wheel metal framework which serves as the mounting for two Rolls-Royce Nene turbojets and provides a platform for the pilot and his controls. It is about 20ft. in diameter, and although no forward propulsion is at present provided for, the pilot can tilt the machine so that it will move slowly in any horizontal direction. The jets not only provide the lift but also the control of the machine.

Captain R. T. Shepherd, who is 58 years old and was chief test pilot of Rolls-Royce for sixteen years before his retirement in 1951, volunteered to pilot the V.T.O. device. He made the first flight at Hucknall on August 3rd. In addition, two other pilots have flown the machine: the present R-R. chief test pilot, Mr. H. Bailey, and S/L. Harvey of the R.A.E.

Sir Winston Presents the Esher Trophy

UNDOUBTEDLY to his own satisfaction, and to that of every member of the unit, Sir Winston Churchill last Sunday presented the Esher Trophy to No. 615 Squadron, R.Aux.A.F., of which he has been the Honorary Air Commodore for the past 15 years. The presentation was made at Biggin Hill.

Addressing the squadron, the Prime Minister recalled the origin of the Auxiliary squadrons, praising their members for giving up week-ends and holidays "to help maintain Britain's fame and prowess in the air. The achievement we celebrate today," he said, "would never have been won if both the officers and airmen of No. 615 Squadron had not given very much more of their time and attendance than the legal minimum required. Much credit falls to S/L. Sowrey, who was in command during the whole of 1953 and to S/L. Eeles, who has now succeeded him." Sir Winston also thanked S/L. Neville Duke, who commanded the squadron during the running-up period (last year No. 615 came second).

At the conclusion of the ceremony, while taking tea in the officers' mess, Sir Winston beckoned to S/L. Cormack of No. 600 Squadron—the mortal "enemies" of No. 615 at Biggin Hill—and dictated to him a telegram he wished sent to H.M. Queen Elizabeth the Queen Mother, who is the Honorary Air Commodore of No. 600. It read: "No. 600 Squadron in their humble duty convey the respects of the Prime Minister, who has today presented the Esher Trophy to his squadron."

Flight" photograph

AWARDED FOR EFFICIENCY: The presentation at Biggin Hill of the Esher Trophy to No. 615 (County of Surrey) Squadron, R.Aux.A.F., by Sir Winston Churchill (see news item on this page). S/L. R. A. Eeles accepted the trophy on behalf of the squadron, which he commands.

America's Big Air Show

REFERRED to by several correspondents as "America's Farnborough Display," though more closely resembling the earlier R.A.F. displays in style, the three-day National Aircraft Show was held at Dayton, Ohio, last week-end. Described as "a report to the people on American air power" this year's event was on a larger scale than any in the past. The Army, Navy and Air Force all participated, and the U.S.A.F. alone had more than 150 jet aircraft taking part. New types seen by the crowd of 60,000 spectators included the production B-52 eight-jet bomber—which had flown 1,968 miles from Seattle to Dayton at about 630 m.p.h. —and the F-100A Super Sabre. Twelve B-57s (Martin-Canberras) took part in a low-level bombing attack, while a novel opening to the programme was provided by twelve F-86s which produced sonic bangs in rapid succession.

Another unusual event was the Allison Trophy competition, which, contested by four Allison-powered F-89D Scorpions, this

NEW CHANNEL FERRY: Air Charter, Ltd., inaugurated their cross-Channel vehicle and passenger ferry on September 1st at Southend Airport, the terminal for four return flights daily by Bristol Freighter to Marck, Calais. Seen boarding the inaugural Freighter is the car of the Mayor of Southend, who was among guests at a reception held in honour of the occasion by the municipalities of Marck and Calais.

FASTEST TURBOPROP TRANSPORT is one of the distinctions claimed for the Lockheed R7V-2 for the U.S. Navy. The power plants are four Pratt and Whitney T34s, with a maximum e.s.h.p. of about 5,700 each. A note on the aircraft appears below.

year took the form of an interception speed climb to 10,000ft, followed by a "pursuit-curve pass" at a B-29 orbiting at 5,000ft.

On the Friday, Major John Armstrong flew an F-86 round a 500-km closed circuit at an average speed of 649.302 m.p.h., thus —subject to confirmation—breaking the 607 m.p.h. record established on May 6th by Captain Westerlund, of the Royal Swedish Air Force, in a Saab J-29. On Sunday, tragically, Major Armstrong lost his life in an attempt to improve on his own record speed, the F-86 crashing a few miles from Dayton.

Turboprop Super-Constellation

THE Lockheed R7V-2, a military transport version of the Super-Constellation powered with Pratt and Whitney T34 turboprops and said to be capable of crossing the Atlantic in 8½ hr, made its first flight at Burbank, California, on September 1st. A photograph appears on this page.

Intended for the U.S. Navy, it is claimed to be the world's fastest airscrew-driven transport, with a maximum speed of about 440 m.p.h. For passenger work 106 seats can be installed; alternatively, 73 patients in stretcher beds, with four attendants, can be accommodated, or there is stowage for 16 tons of cargo.

Mr. H. P. Folland

FOR many members of the industry a shadow was cast over the opening day of the Farnborough Show by the news that an old and respected member of their community had passed away on Sunday. He was Mr. H. P. Folland, O.B.E., F.R.Ae.S., F.I.Ae.S., F.R.S.A., designer of military aircraft in both wars and a director of the company bearing his name. Sixty-five years of age, he died at his home near Nottingham after a long illness. Ill-health had, in fact, compelled his retirement in 1951 from the managing directorship of Folland Aircraft, Ltd.—Mr. W. E. W. Petter succeeded him to the post —but he retained his seat on the Board. Henry Phillip Folland served his apprenticeship in the motor industry and then became an assistant designer at Farnborough; this was in 1912. From then until 1917 he was largely responsible for the design of such famous aircraft as the S.E.4, S.E.5 and F.E.2B. Subsequently, as chief engineer and designer to the British Nieuport Co., Ltd., he designed the Nighthawk fighter and the London triplane bomber. He joined the Gloster Aircraft Co., Ltd., in 1921, and numbered among his successes the Bamel racer—winner of the aerial Derby in 1921, '22 and '23—and the Gloster III, IV and V Schneider Trophy racing seaplanes. Fighters bearing the Folland stamp were the Grebe, Gamecock, Gambet, Goldfinch, Gauntlet and Gladiator biplanes, and the F.5/34.

H. P. Folland.

Mr. Folland leaves a widow and two sons, both of whom are in aviation. The funeral took place privately at Nottingham last Tuesday. Mr. Folland had requested that, instead of sending wreaths, friends should contribute to the R.A.F. Benevolent Fund.

Migs. v. Neptune

ANOTHER shooting incident involving Communist and American aircraft occurred over the Sea of Japan on September 4th. The Defence Department announced that a Neptune of the U.S. Navy, while on routine patrol at a point approximately 100 miles east of Vladivostok and 44 miles from the Siberian mainland, had been attacked and shot down by two jet aircraft "apparently of the Mig-15 type." Nine of the ten men on board were picked up by American air/sea rescue units.

Shortly afterwards, the Soviet Acting Foreign Minister in Moscow handed a protest to the American Ambassador, alleging that the Neptune had "violated the State frontier of the U.S.S.R. in the area of Cape Ostrovnoi," and that it had fired on two Soviet fighters which had approached in order to warn it off.

A subsequent American Note of protest described this assertion as "completely without foundation" and said that the Russians had fired without warning, whereas the Neptune never fired at all.

More About the BE.25

LAST week gave the first news of the new Bristol BE.25 turboprop, which is assuredly designed to become one of our most valuable airscrew-driving engines in the big-power category. For the first time, say Bristols, "a turbine engine can compete with a diesel in economy."

The BE.25 is to be a two-spool engine, and in this respect it will resemble the Olympus, although it will be much smaller than that engine. Sir Alec Coryton, managing director of the Bristol Engine Division, has pointed out that the company have taken the best features of the Olympus and Proteus and produced an engine which will be "the logical power-plant" of the next generation of airliners.

A fundamental feature of the BE.25, and one which makes it unique among gas turbines, is that it is to be developed to give a maximum power which does not fall off with height, i.e., in this respect it will resemble supercharged piston engines. The maximum power of the BE.25 has been fixed at 4,000 h.p., and this is maintained at all heights up to a considerable altitude (20,000ft according to an American report). This makes available full power for take-off at any height and in any temperature.

Shannon Accident

LESS than a fortnight after losing a DC-6B, K.L.M. suffered another stroke of misfortune in the early hours of Sunday last, September 5th, when their Super Constellation PH—LKY *Triton* fell into the Shannon estuary. Twenty-eight of the 56 people on board lost their lives.

The accident occurred less than two miles from the end of the runway from which the aircraft had just taken off on the final stage of its flight from Amsterdam to New York. The survivors—22 passengers and six crew members—managed to reach the shore in the aircraft dinghies. *Triton*, apparently not badly damaged, was in only a few feet of water, but the tide was rising rapidly and the fuselage was submerged by the time rescue teams from the airfield arrived. First statements suggest that the majority of the casualties, if not all, were caused by petrol fumes rendering the passengers unconscious so that they drowned in the shallow water. It was reported that nearly 3½ hours elapsed before the rescue teams arrived. Apparently nothing had been known of the crash—which occurred at 3.40 a.m.—until Johan Tieman, the second co-pilot and navigator, gave the alarm at 6.10 after swimming to a mud flat and crawling through two miles of mud to the river bank.

Fortunately the whole of the flight crew survived (the two stewards and the stewardess lost their lives), so there should be expert first-hand information as to the cause of the accident. The captain was Adrian Viruly, K.L.M.'s commodore, who has flown over two million miles.

General I. A. Aler, president of K.L.M., who was on a visit to Dublin, travelled immediately to the scene of the accident.

A.T.A.C. Annual Report

IN a foreword to the annual report of the Air Transport Advisory Council for the year ended March 31st, 1954, the former Minister of Transport and Civil Aviation, Mr. Alan Lennox-Boyd, notes that British independent operators almost doubled their traffic in 1953 and introduced many new services not previously available to the public. The Corporations, however, were left to contribute 96.3 per cent of the total effort devoted to the provision of scheduled services by U.K. operators.

The air-transport policy introduced by the Government in July 1952 sought both to preserve and to strengthen the Corporations'

ADMIRALTY VISITOR to the Brough works of Blackburn and General Aircraft, Ltd., was the Fifth Sea Lord, Rear-Admiral A. N. C. Bingley, O.B.E., R.N. He is seen (left) accompanied by Mr. Eric Turner, the company's managing director and (right) Captain E. D. G. Lewin, C.B.E., D.S.O., D.S.C., R.N., Director of Air Warfare. Blackburns have, of course, a long association with the Fleet Air Arm; and there should be Naval uses for their "Anglicized" versions of Turboméca units.

HERALDING THE HERALD: Sir Frederick Handley Page introduces Mr. A. A. Boyd-Carpenter, Minister of Transport, and Mr. George Ward, Under-Secretary of State for Air, to features of the Herald transport. On the same occasion—a reception at Londonderry House—Sir Frederick announced that the Herald would cost about £125,000, and that the company were prepared to discuss extended payment. A message from the Minister of Supply, expressed possible interest in a military version.

FROM ALL QUARTERS . . .

position in the international field and to improve the position of the independent companies. Mr. Lennox-Boyd agreed with the A.T.A.C. that it was still too early to make any firm assessment of the value of services approved under the new policy; the results of the first full year of operation, although not conclusive, were nonetheless encouraging.

The report states that 93 applications for new services and 37 applications for amendments to existing services were received during the period reviewed. The Minister accepted 115 of the 118 recommendations made by the A.T.A.C., and was examining with authorities overseas the three outstanding applications.

While the primary task of the A.T.A.C. is the consideration of applications for scheduled air services under terms of reference laid down by the Government, it also has the duty of considering complaints made by members of the public as to the adequacy or cost of services provided by the Airways Corporations. The fact that such representations can be addressed to the A.T.A.C. is not widely known—as indicated by the fact that only one complaint was made during the period reviewed.

The complainant was Maj. Oliver Stewart, who criticized the bus services provided between London Airport and Northolt and the city terminals of B.O.A.C. and B.E.A. Acting on an A.T.A.C. recommendation, the Minister of Transport and Civil Aviation asked both Corporations to examine the possibility of arranging one or two set-down points between the airports and the central terminals. Both B.O.A.C. and B.E.A. considered that their existing non-stop bus services should be continued, but B.E.A. agreed to conduct a short-term experiment in setting-down passengers at an intermediate point. As a result of Maj. Stewart's efforts, all B.E.A. passenger buses inbound to Waterloo now stop on demand at the intersection of Cromwell Road and Gloucester Road, Kensington.

Lady MacRobert

WE regret to record the death, on September 1st, of Lady MacRobert, whose war-time gifts to the Air Ministry, in memory of her sons, will be remembered. All three of her sons were killed while flying. The eldest, Sir Alasdair MacRobert, died in an accident at Luton in 1938; the two remaining served in the R.A.F. during the war, and lost their lives in the early years of the conflict, Sir Roderic while with a Hurricane squadron in Iraq, and Sir Iain while flying a Blenheim of Coastal Command.

In their memory, Lady MacRobert gave £25,000 in 1941 to purchase a Stirling, named at her request *MacRobert's Reply*. It took part in many raids over Germany. In the following year she gave £20,000, this time for four Hurricanes, three of which were named after her sons, while the fourth was *MacRobert's Salute to Russia*. These four aircraft went into action over El Alamein, and then in other parts of the Middle East. In 1943, also, Lady MacRobert gave her country house in Aberdeenshire to the R.A.F. as a leave centre for officers and aircrew.

Lady MacRobert, who was 74, was the widow of Sir Alexander MacRobert, founder of the British India Corporation, who died in 1922. The family's motto was "Glory is the reward for valour."

When her funeral took place at Douneside, near Aberdeen, on September 4th, nine Meteors from Leuchars flew low overhead as a tribute from the R.A.F. The Air Council was represented at the funeral by A.V-M. R. L. Ragg.

Battle of Britain Fly-past and "At Homes"

PRECEDED by two historic piston-engined types, a Hurricane and a Spitfire, 185 jet aircraft of the Royal Air Force, Fleet Air Arm, R.C.A.F. and U.S.A.F. will fly over London on Battle of Britain Day, Wednesday next, September 15th.

The fly-past, controlled by A.V-M. H. L. Patch, C.B., C.B.E., the A.O.C. No. 11 Group, Fighter Command, will rendezvous over Southend Pier and fly in a straight line to London. The Hurricane and Spitfire, flying side by side at 160 kt, are due to pass over the Air Ministry, Whitehall, at 12.30 p.m. Alternative times, should weather interfere, will be 5 p.m. the same day, or 12.30 p.m. or 5 p.m. on the following day.

In accordance with tradition, the names of the pilots of the Hurricane and Spitfire will not be disclosed. The other formations, the squadrons concerned, the names of the leaders and the speeds at which the aircraft of each formation will fly, are as follows:—

Formation 2: 24 Meteors of Nos. 64 and 65 Sqns., Fighter Command; W/C. P. Wickham, D.S.O., D.F.C.; 300 kt (345 m.p.h.). **Formation 3:** 24 Meteors of Nos. 257 and 263 Sqns., Fighter Command; W/C. C. S. Vos, D.F.C.; 300 kt (345 m.p.h.). **Formation 4:** 24 Meteors of Nos. 54 and 247 Sqns., Fighter Command; W/C. J. H. S. Broughton, D.F.C., A.F.C.; 300 kt (345 m.p.h.).

Formation 5: 12 Sea Hawks of No. 807 Sqn., Fleet Air Arm; Lt-Cdr. P. J. Hutton, R.N.; 300 kt (345 m.p.h.).

Formation 6: 18 Canberras of Nos. 35, 90, 115, 207, 40 and 76 Sqns., Bomber Command; W/C. A. W. Southall, D.S.O., D.F.C., A.F.C.; 330 kt (380 m.p.h.). **Formation 7:** 18 Canberras of Nos. 10, 18, 21 and 27 Sqns., Bomber Command; S/L. N. B. Freeman, A.F.C.; 330 kt (380 m.p.h.).

Formation 8: 24 Sabres of Nos. 66 and 92 Sqns., Fighter Command; W/C. L. A. Malins, D.S.O., D.F.C.; 340 kt (392 m.p.h.). **Formation 9:** 24 Sabres of Nos. 410, 439 and 441 Sqns., R.C.A.F.; S/L. D. Warren, D.F.C.; 340 kt (392 m.p.h.). **Formation 10:** 12 Sabres of the 91st and 92nd Fighter-Bomber Sqns., No. 81 Fighter-Bomber Wing, U.S.A.F.; Col. Benjamin N. Cassiday, Jr.; 340 kt (392 m.p.h.).

Formation 11: 5 Swifts of No. 56 Sqn., Fighter Command; W/C. K. M. Giddings, O.B.E., D.F.C., A.F.C.; 400 kt (460 m.p.h.).

The Hurricane and Spitfire will fly past at 1,000ft. The other formations will fly at alternate levels of 1,700 and 1,200ft. The formations will cross Whitehall at 30-second intervals, breaking away a mile farther on to return to their bases. Flares to guide the aircraft will be burned at strategic points along the route to London.

On the following Saturday, September 18th, fifty-eight R.A.F. stations will be "at home" to the public. We gave a list of these stations in our issue of August 20th, but repeat them here for the benefit of those who missed the earlier note:—

Berkshire: Abingdon. *Buckinghamshire:* Halton. *Cambridgeshire:* Waterbeach. *Cheshire:* Hawarden; Hooton Park. *Cornwall:* St. Mawgan. *Devon:* Chivenor. *Durham:* Middleton St. George. *Essex:* Debden. *Gloucestershire:* Filton; Little Rissington; Aston Down. *Hampshire:* Andover; Odiham; Thorney Island. *Huntingdon* Upwood. *Kent:* Biggin Hill; West Malling. *Lancashire:* Kirkham. *Lincolnshire:* Binbrook; Hemswell; Scampton. *Middlesex:* Hendon. *Norfolk:* Horsham St. Faith; Marham. *Northumberland:* Ouston *Nottinghamshire:* Newton. *Oxfordshire:* Benson. *Shropshire:* Ternhill; Shawbury; Bridgnorth. *Somerset:* Merryfield. *Staffordshire:* Cosford. *Suffolk:* Wattisham. *Surrey:* Headley Court. *Sussex:* Tangmere. *Warwickshire:* Castle Bromwich. *Wiltshire:* Colerne. *Yorkshire:* Catterick; Church Fenton; Dishforth; Driffield; Leeming; Lindholme; Linton-on-Ouse; Thornaby; Norton. *Isle of Man:* Jurby. *Scotland:* Bishopbriggs; Dumfries; Dyce; Leuchars; Turnhouse; West Freugh. *Wales:* Pembrey; Pembroke Dock; St. Athan. *N. Ireland:* Aldergrove.

HERE AND THERE

CANBERRA WITH A TWANG: This latest picture of a Martin B-57 (licence-built English Electric Canberra) shows features of American origin, notably the Martin-developed rotary bomb door, with a clutch of bombs exposed; napalm tanks beneath the wings; and American-built Armstrong Siddeley Sapphire turbojets. The B-57 made its first public appearance at the National Aircraft Show, Dayton, last week-end, as reported on an earlier page.

NATO Inspection

ON September 8th Mr. Roger Lewis, United States Assistant Air Secretary, was due to leave Washington for a three-week visit to Europe, including Great Britain. He is studying the manufacture and distribution of aircraft for NATO countries.

Well-known U.S. Pilot Passes

BERT ACOSTA, who gained fame in American aviation in the early 1920s, has died at Denver, Colorado, at the age of 59. In 1921 he established an air speed record at 179.6 m.p.h. and in 1927 he piloted Admiral Byrd's three-engined Fokker across the Atlantic.

Soviet Polar Flights

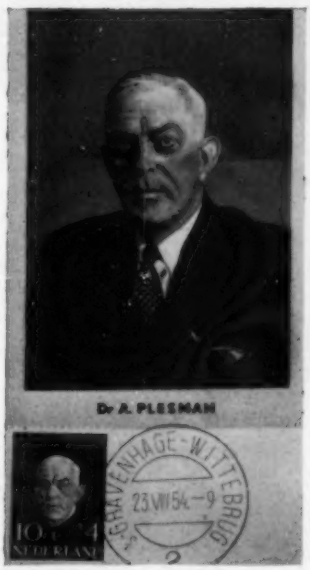
FOR several weeks past the Soviet newspapers and radio have been devoting much space and time to reporting flights over the North Pole and Arctic by Russian aircraft. It is said that scientists have established a number of camps on floating ice and are making considerable use of helicopters for communications. Much of the equipment for the bases was flown to the Arctic.

Far East Redeployment

THE U.S.A.F. announced in Tokio last week that 5th Air Force H.Q. is to be moved from Korea to Nagoya, in Japan, and that a number of Air Force units will, during the coming months, move from Korea to other areas in the Far East. From Washington, a "Pacific realignment" is announced. As part of it, B-36s will go to this area for the first time; ten of them are to be based on Guam Island.

Alamein Memorial Unveiling

THE Imperial War Graves Commission states that it has now become possible for next-of-kin in organized parties to attend the unveiling, by Field Marshal Viscount Montgomery, of the Alamein Memorial on October 24th. Particulars are obtainable from the Commission's offices at Wooburn Green, High Wycombe, Bucks.



"MAXIMUM CARD" from K.L.M. (see below).

Collector's Piece

PHILATELISTS attach particular value to what are known as "maximum cards," i.e., postcards bearing a stamp showing the same picture as the card itself, and cancelled at a place and/or on a date connected with the illustration, so that the card, stamp and postmark are all related to one another. The Netherlands Post Office is now issuing stamps surcharged in aid of the Dutch National Aviation Fund, and one of these stamps, showing the late Dr. Plesman, K.L.M.'s first president, is seen in this reproduction of a "maximum card" we have received from K.L.M. The card was postmarked on the first day of issue at the Witteburg Post Office in The Hague—the town where Dr. Plesman was born, lived, worked and died.

The Official History

NEXT Monday—the beginning of Battle of Britain week—H.M. Stationery office is to publish *The Fight is Won*, the third and last volume of the official history of the R.A.F. in the 1939-45 war

Gen. Hamilton Joins Hillers

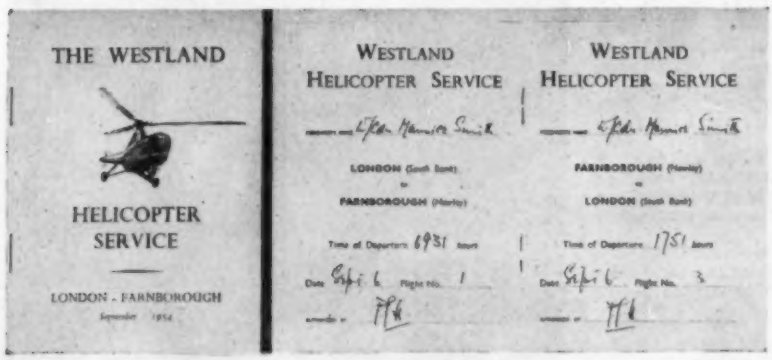
A VETERAN pilot of World War I, Brig. Gen. Pierpont M. Hamilton, U.S.A.F. (retd.), has been appointed to the Board of Hiller Helicopters. His last assignment in a long and distinguished Service career was the negotiation of air base rights for NATO and the U.S.A.F. in France in 1952.

Artificial-light Photography

READERS who are also camera enthusiasts are reminded that the next issue of our associated journal *Amateur Photographer*, appearing on September 15th, is a special number devoted to indoor photography; contents include a review of lighting equipment, enlargers, projectors, etc., on the British market.

A Normandy Landing

WHILE operating a scheduled service from Southampton to London Airport, a B.E.A. Bristol 171 made a precautionary landing on a cricket pitch at Normandy, near Guildford. A faulty instrument had led the pilot, Capt. R. Dibb, to suspect gear-box overheating. A relief helicopter took three of the passengers on to London Airport; an agency report says that the fourth, who was making the flight solely for pleasure, was "last seen making for the railway station."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Date Sept 6 Flight No. 1
WESTLAND HELICOPTER SERVICE
FARNBOROUGH (Hawley) to LONDON (South Bank)
Time of Departure 1.45 p.m. hours
Date Sept 6 Flight No. 3

QUICKEST, EASIEST way of reaching the S.B.A.C. Show from London is by the Westland Company's S.51 private helicopter service from the South Bank to Hawley Hotel, near Farnborough. This is a ticket issued to the Editor.

"FLIGHT"

PHOTOGRAPHS

Cloud-base 400ft, visibility one quarter mile; and Dave Morgan brings the Swift overhead in a thundering pass with reheat.

FARNBOROUGH '54

The Harvest of Another Year

MONDAY, September 6th—"technicians' day" of the Fifteenth Display and Exhibition of the Society of British Aircraft Constructors—broke smilingly; but cloud was massing, and by the time the last of the aircraft viewers had been cajoled from the static park around mid-day (in order that the machines could be towed back to their "flying" stations) the rain was teeming down and two successive fronts were driving in.

At the pilots' briefing, G/C. S. W. R. Hughes, Superintendent of Experimental Flying at the R.A.E., had wryly observed that we had British aeroplanes, British pilots and British weather; and how right he was. Even before the met. turned sour, however, the great exhibition tent had filled to its comfortable capacity, and there was a steady convergence on the caravans.

The colour for which the display becomes increasingly famed year by year did not attain its full range and brilliance until the morning of Tuesday, when the sun glowed and visibility was infinite. The scene had been further graced by the arrival, after Monday's flying, of P.A.A.'s first Viscount, shiny new from the shops at Hurn and gayest of all the transports.

As we write this paragraph the aircraft are positioned for their display under the most favourable conditions. The Proteus-Ambassador opens this first official guest-day, floating steeply aloft with no more than a throaty whistle, and the other group demonstration followed, the Armed Provost outstanding for its aerobatics, particularly with violent reversals of bank in the dives. But it is the Canberras, of course, that bring even the best-lunched visitors to their seats; the searing crackle of the Sapphire-Canberra . . . the outstanding Olympus-Canberra, whispering past at 50 feet, then suddenly thundering into life and simultaneously pointing itself almost vertically skyward, poised on two thin black smoke columns.

Further sensational flying was to follow: the first public demonstrations of the Folland-Midge—looking like a small guided missile rocketing skyward—and the Fairey F.B.1, with an astounding rate of roll; the Valiant B.2, leaving blowholes in the clouds; the Comets 2 and 3; the five Javelins; sonic bangs from Lithgow (Vickers-Supermarine 525) and Duke (Hunter F.6), the latter with the fastest low run seen this year. But of such joys, more next week; now to start at the beginning.

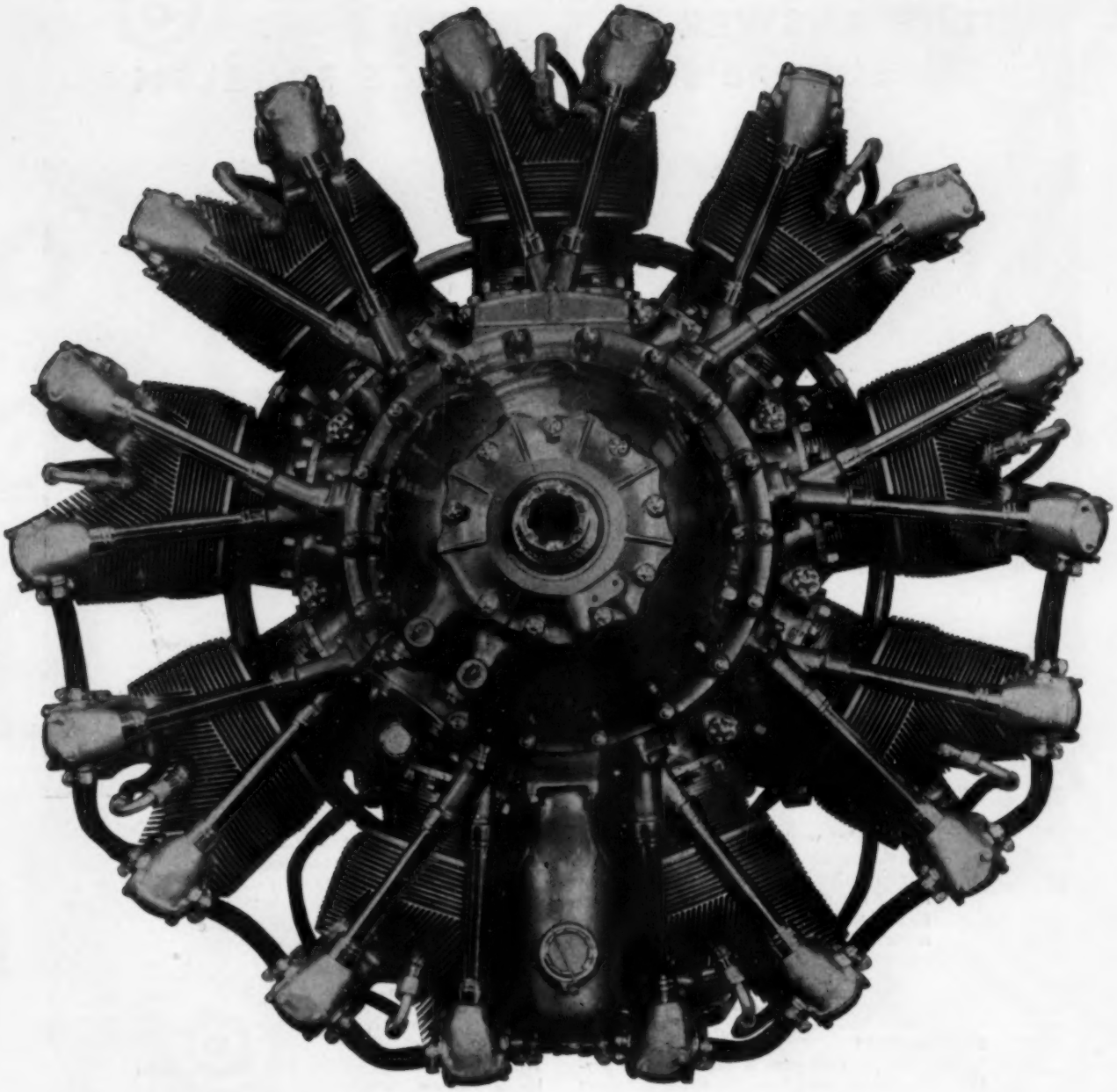
Throughout Saturday the demonstration aircraft had been swarming, and presenting themselves one by one behind the photographic Packet, from the back doorway of which L. W. McLaren was securing the choice collection of "aerials" in these pages. When we of *Flight's* editorial advance-party drove on to the airfield next morning we were confronted with as gay a gallimaufry as could be wished for, though several contingents of aircraft had still to take up position.

In the misty blue a silver Seamew piped a sibilant little song as it waited to pose for its picture, while a garish red-and-yellow Firefly 8 strutted to and fro like a gamecock to the less patient note of its Griffon. Then out of the north, like a white avalanche, swept the Sapphire-Vulcan. From the main aircraft park (it reminded us this year of a Noah's Ark, especially as some machines had come in two by two) the glinting black Canberra B.8 intruder nosed out for a Sunday-morning constitutional, the form of which was, we are inclined to think, the most perfect piece of demonstration flying we have ever witnessed. But we must not anticipate our detailed report of the flying display by eulogizing this classic piece of airmanship.

The tiny blue Midge was another aspirant which took a turn round the sky on Sunday; and we saw, too, the five Javelin deltas, rampaging across the field like a troop of Cavaliers before drawing rein and setting up a camp of their own.

Those happy few among the caravan community who were dozing slyly in the warmth of the afternoon were brusquely roused by a double sonic bang; whereupon a Swift, raging and rumbling

Taken by the Editor from Westland's S-51 flying the first private service from the South Bank: a study in black and white V-bombers.



The Alvis Leonides — 550 b.h.p. 9-cylinder air-cooled radial engine. Weight complete 796 lb. Power/weight ratio 1·45 lb. (0·657 kg.) per b.h.p. Overall diameter 41·5 in (105 cm.) In quantity production for the Royal Navy, the Royal Air Force and Commercial Operators.

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THE ANSWER TO EUROPE'S AIR DEFENCE PROBLEM

Trends that were unchecked for forty years so increased the size, weight and cost of the standard fighter and the difficulties of its design, production and operation, that few countries have the resources to build or buy the fighters they need for their defence. A halt has now been called, and a new trend started by the Folland Gnat, a light jet fighter with a flying and fighting performance that meets the sternest demands of modern war and provides the answer to Europe's air defence problem.

The following comparisons with the standard fighter illustrate some of the more significant merits of this new type of aircraft.

● MAN-HOURS
Tooling time for production is halved, and twenty-five light fighters instead of five standard fighters can be built in the same number of airframe man-hours.

● COST
Twenty light fighters, fitted with all essential flying, navigational and armament equipment, can be built for the price of six standard fighters.

● FIRE-POWER
The five light fighters produced in the time needed for one standard fighter can bring to bear 10 × 30-mm. cannon instead of the 4 × 30-mm. cannon, or 6 × 0·5-in. machine-guns of the standard fighter.

● HANDLING
With its high thrust-weight ratio, powered controls, and low lateral inertia, the light fighter will have outstanding manœuvrability. Pilots can learn to fly it in less time because of its simplicity and handiness.

● SERVICING
The simplicity of aircraft services and the smaller amount of equipment installed cut servicing time and increase operational strength. All items needing routine attention are sited where they can be reached without trestles or staging.

● MOBILITY
Light fighters can be carried by air freighter, ship or lorry with little or no dismantling, and can be given ample flight duration for ferrying by the use of long-range tanks.

The Gnat and its first prototype, the Midge (pictured above), are private ventures by

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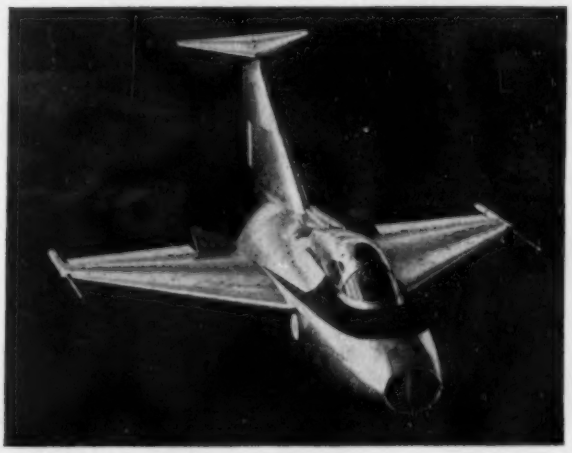
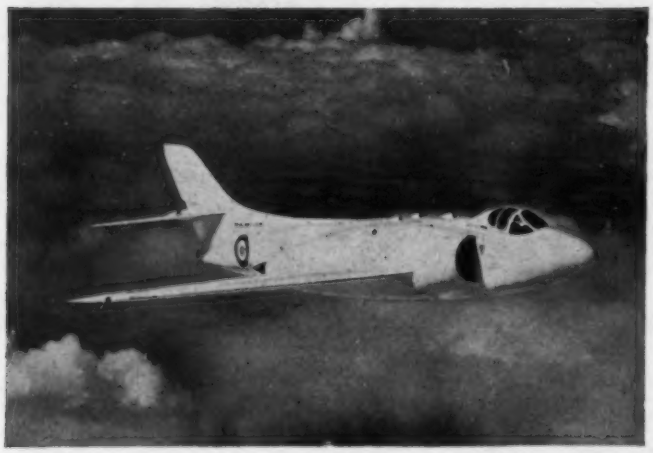




with reheat, came scorching up the runway. Last we beheld with admiration (for, though plump in girth, it has a singular beauty of line) the Supermarine 525, glistening creamy white in the lowering sun.

So compelling were the proceedings in the air that it was some time before the innovations on the ground became apparent to us, extensive though they are. Chiefly they concern the static exhibition, set atop a well-drained gravel plateau, with a flag-lined rising approach of tarmac. Here is architectural nobility in canvas, and on a scale scarcely rivalled, for the floor area amounts to some 101,000 square feet and the exhibitors total 293. Of these, eighteen show large items of equipment in the open air.

By tea-time on Sunday it seemed to us that preparations were

FARNBOROUGH '54 . . .

Uppermost in these "Flight" photographs, the five Gloster Javelins—three prototypes and two production aircraft—are seen getting into their stride on Sunday morning, and to the right, the Folland Midge peels off from the photographic Packet. (Note in this view how anhedral disguises the sweepback.) Below the Javelins a Hunter is coming alongside to demonstrate its massive curved air brake, and to its right the Fairey F.D.1 displays its own braking surfaces. Immediately above is the handsome cream-coloured Supermarine 525, and, sweeping by in regal passage on the right is the de Havilland Comet 3.

(Above) *The hydraulic system for a Hunter speed-brake gets a manual once-over; (left) the trim Saro Skeeter 6 pirouettes on the power of its direct-injection Gipsy Major.*

FARNBOROUGH '54 . . .

further advanced than we had come to expect at that stage of the proceedings. There was, however, some resentment and despondency that the statically shown aircraft were to be ordered away before the public days to make yet more room for the expected multitudes. (Last year's attendance figures were: Friday, 18,600; Saturday, 130,000; Sunday, 153,000.)

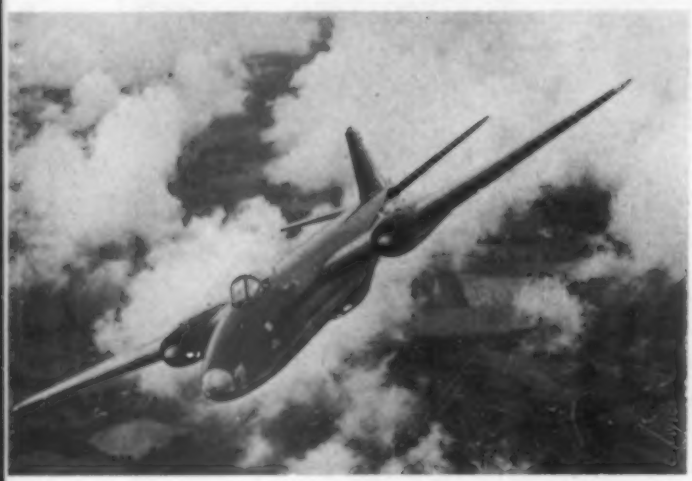
As for the all-important aspect of flying control, it is this year once again in the hands of a committee, comprising five S.B.A.C. representatives and four from the staff of the R.A.E. Chairman is G/C. Hughes, and the vice-chairman is an S.B.A.C. nominee. As last year, no turns are permitted towards—and no manœuvres over—the crowd. Minimum height for fly-pasts right-way-up is 50ft; inverted runs must be made higher, at the pilot's discretion. Speed allowance is up to 95 per cent of the approved safe speed of the aircraft. Notice of intended sonic banging was filed on behalf of the D.H.110, Supermarine 525 and Swift, and the Hunter.

THE FLYING DISPLAY

DANK cloud had draped itself down to 600 feet or lower when the air display opened at 1430 hours on Monday. That flying should have started at all under these conditions must have surprised those who were unaware of the "press-on" tradition of these displays—a tradition nurtured over the years in face of recurrent handicaps and hazards. On this particular occasion only one thing was clear: that something quite exceptional, even historic, in the way of demonstration flying was to be witnessed if the programme was to proceed as declared. And proceed it did. New Farnborough history was duly made, new honours accrued to the pilots, and new evidence was forthcoming of the qualities of Britain's aircraft. And in spite of everything, some new contributions were made to the art of demonstration flying.

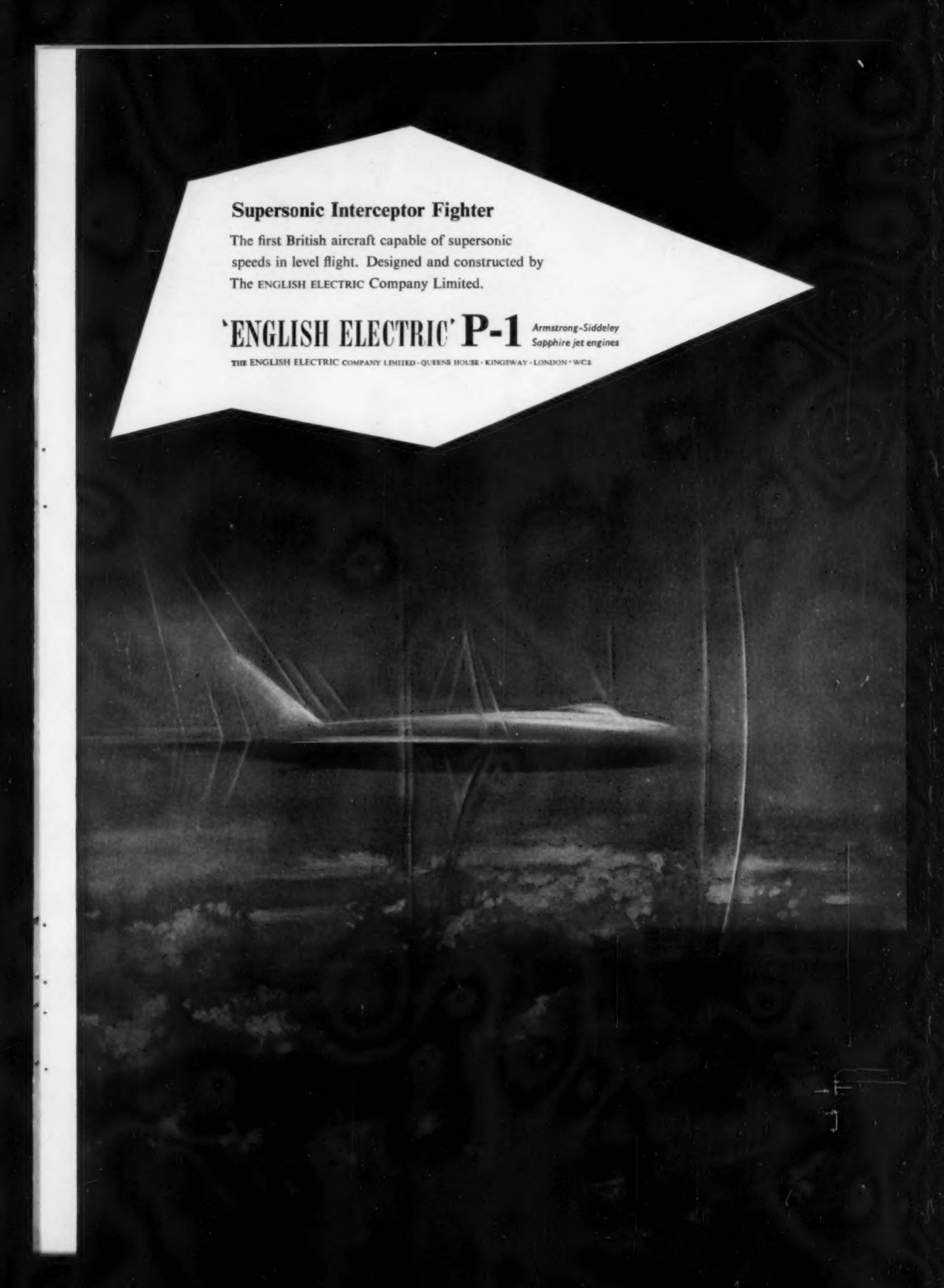
First of the group demonstrations (colloquially "Circus A") was an all-airscrew affair, involving Bristol's broad-spanned, double-humped Proteus 705-Ambassador test-bed, a Hunting Percival Survey Pembroke, debonair in Belgian military markings, a glossy de Havilland Heron 2 (one of a batch of seven for Turkish Air Lines), and Napier's portly Eland-Varsity.

That the Proteus, in addition to its other manifold virtues, possesses that of quietness was obvious on take-off, when the two great turboprops could have been little throttled, if at all. The Pembroke's military air was matched by the smartness of its take-off and undercarriage retraction, and the Heron looked and behaved like the very best kind of airliner. Napier's Varsity progressed at a vigorous pace under the smooth flow of power from the slender Elands, submerged in its massive nacelles (a piston-



(Left, above) *A pleasing study of the Canberra B.8; (left) Roly Falk holds the Vulcan's nose high during the landing roll, presenting a mighty area of wing to help slow him down.*

(Right) *Neville Duke makes what was probably the fastest pass during the whole of Monday's drizzling afternoon, in the five-figure-thrust Hunter 6.*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Problems of flight

FOLDING WINGS

Folding wings have been used by beetles since evolution was young. Man, in the carrier-based aircraft, has faced only recently the problem that Nature solved so long ago.

There are nearly as many different reasons for folding wings as there are different kinds of beetle — and beetles, with their 250,000 species, are the largest order in the animal kingdom. Their habits vary widely. Some no longer fly; some never did. Those that do have heavier bodies than any other flying insect, because of their thick plates of protective armour. (Some also have enormous jaws: those of the male stag-beetle illustrated may be for fighting other males during the mating season, or perhaps for scraping plant-shoots to get at the sap.)

This great weight demands large wings. Hence Nature's problem. For many beetles burrow into the earth; many fight; many find their food or their safety in cracks in wood or chinks in stone. Unfolded wings would make all this impossible. And the beetle's wings are fragile. To keep himself airworthy he has to protect them under armoured covers. (These covers are actually his fore-wings, specially adapted for this special task.)

As in the crowded turmoil of the insect world, so in the tight space of an aircraft carrier. Man has taken yet another leaf out of Nature's great book— has found to yet another of his problems another time-honoured answer.

Pilots whose planes do not need the refinement of folding wings—because they land them at any of Britain's airfields—value the excellent and helpful service of the Shell and BP Aviation Service.

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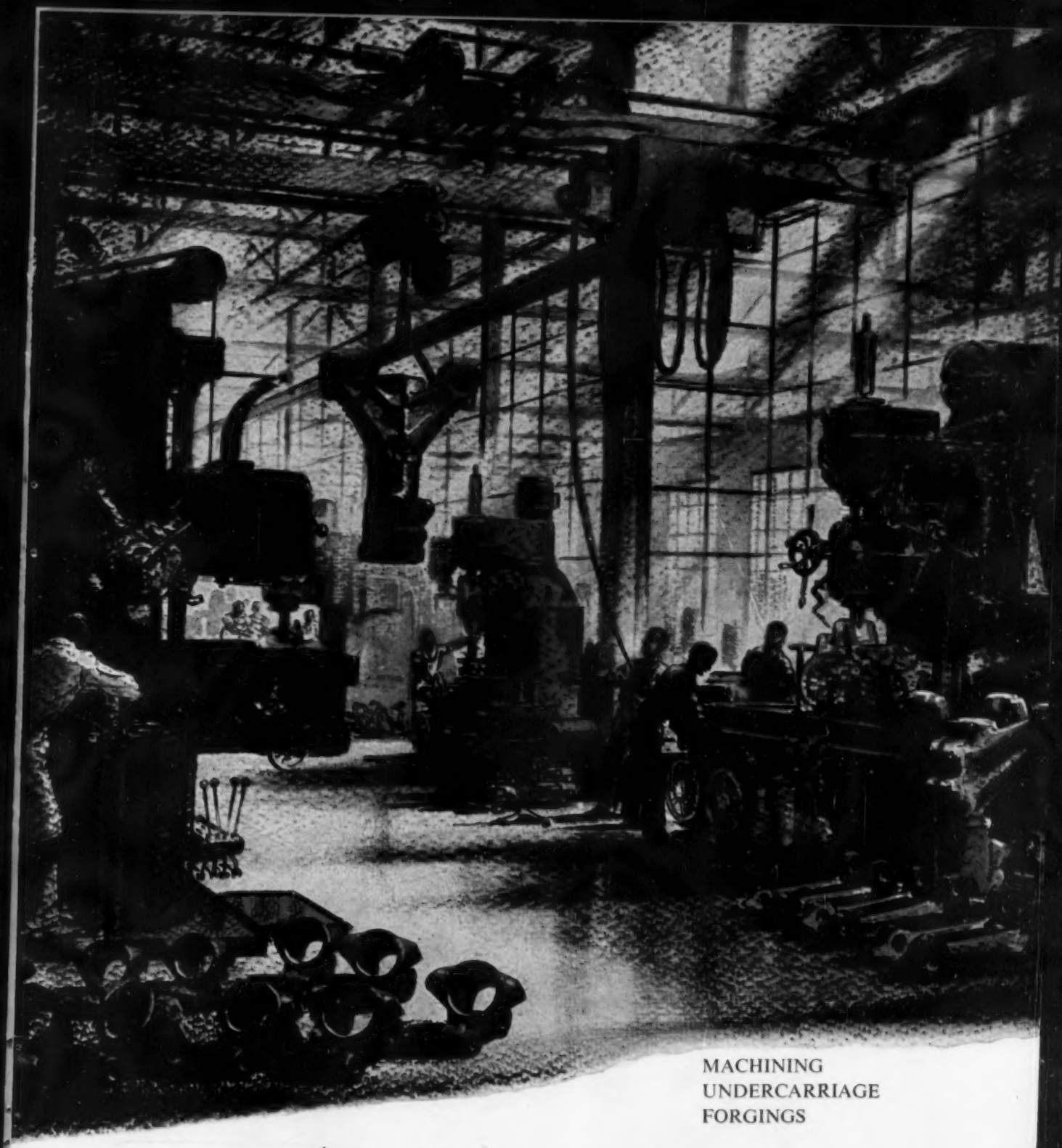

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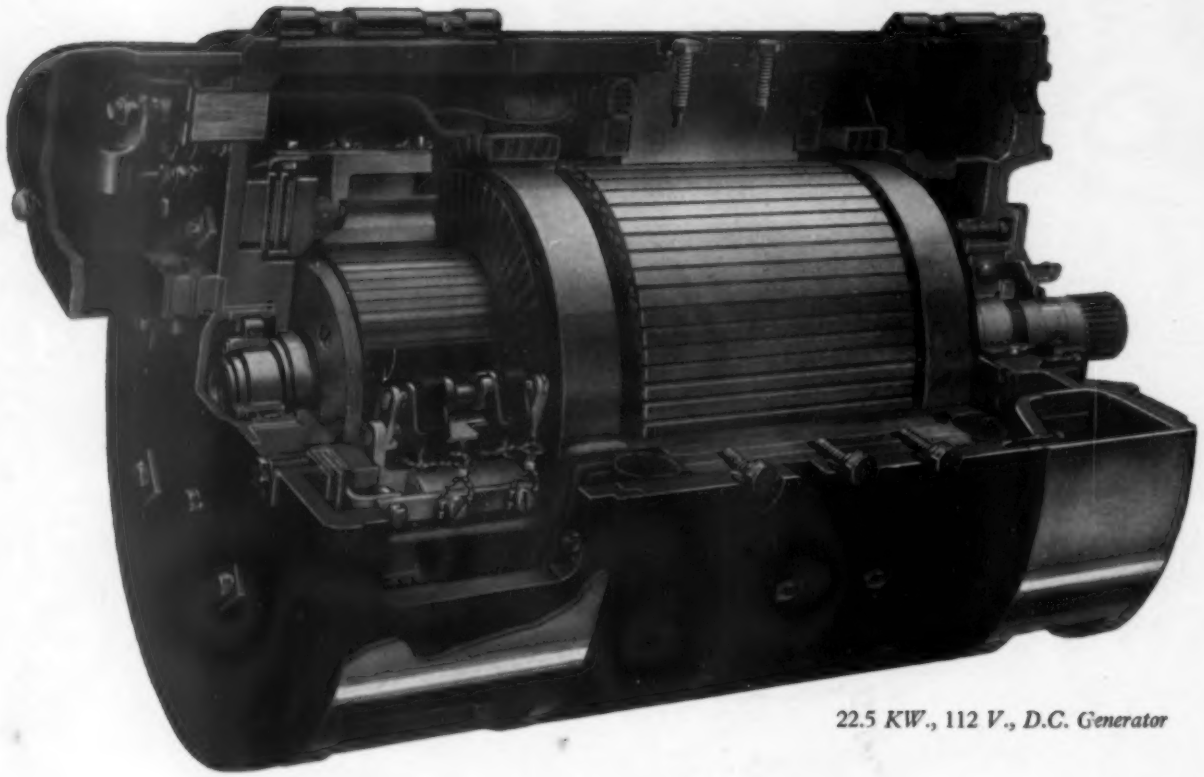

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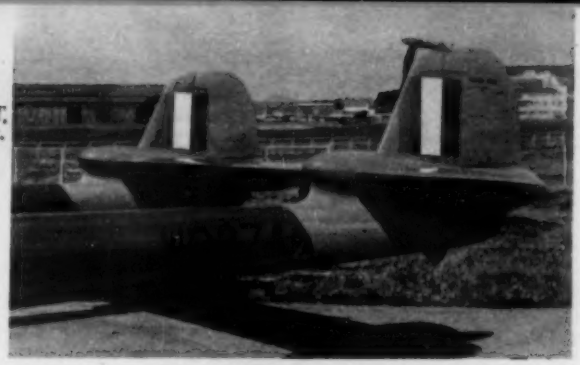
Lucas-Rotax (Australia) Pty. Ltd., Nepean Highway, Cheltenham S.22, Victoria, Australia.
Lucas-Rotax Ltd., Scarborough, Ontario, Canada.



Above, the Venom F.B.4 tail, with revised fins but retaining the extended tailplane; upper right, a corner of the static park, with Glosters' private Meteor in the foreground; right, the stubbiest of midgets, the Fairey F.D.1.

FARNBOROUGH '54 . . .

powered inheritance), but provided an instant of uneasiness when, on touching down, it skidded 15 degrees or more towards the edge of the glistening runway.

Like this first group, the second was presented not as a beauty chorus, but to exemplify more types of airscrew-driven machines, each with a definite and important purpose. There was de Havilland's demonstration Beaver 2, laden with passengers (all guaranteed genuine), and Hunting Percival's Armed Provost, in the markings of Burma, laden with equally genuine RP.s. Austers were there with a new production A.O.P.9 in its drab field-service dress, but the Scottish Aviation Prestwick Pioneer 2 was in its shiny silver plating, emblazoned proudly with its style and title. All four machines—as we knew they would—unstuck with alacrity and touched down with determined adhesion.

The lively dispositions of the A.O.P.9 and Armed Provost could not be wholly subdued by the ambient dampness and dimness. The Provost, in fact, nipped up into the cloud like a nimble nut-laden squirrel for a diving re-entry and a racy sequence of rolls, while the Pioneer landed crosswise on the runway and sat down with characteristic slow dignity in the wet, braking to a stop in a few lengths. Deep were the regrets that its twin-engined kinsman, or clansman, was not quite ready for the gathering.

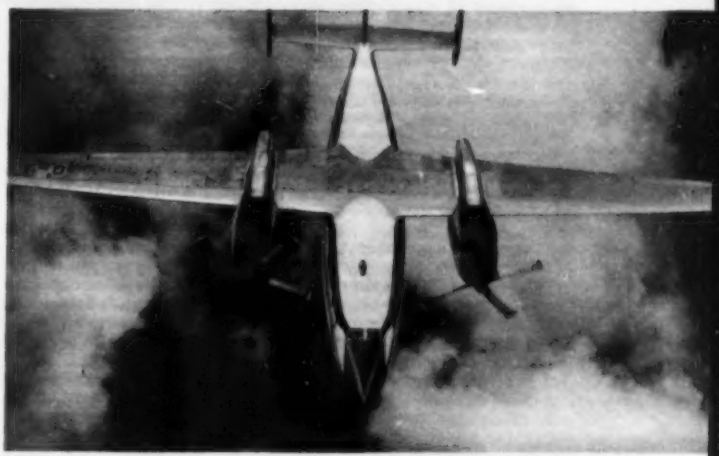
Circus C comprised a brawny production Gannet A.S.1, Boulton Paul's new Balliol demonstrator, and, by way of introduction to jettery, Rolls-Royce's engaging Soar-Meteor test bed.

In trim for a strike—that is, with radar "bin" lowered and weapons bay wide open—the Gannet passed by at a highly respectable rate of knots. It seems to have everything laid on, including (it was announced) two radar scopes to minimize crew fatigue. With its uninhibited Merlin-note and brisk manœuvres in the rolling plane, the red Balliol was in high feather, and the Meteor, with its Derwents shut down, passed the enclosures without difficulty on the thrust of its tip-mounted Soars. Being smoothly clad at birth, these baby axials need little or nothing in the way of cowling—even, as it was remarked, in this country.

With an exultant Avon-roar, a silver Canberra P.R.7 was next up and away. Two miles from the perimeter, on his run in, the pilot declared that he was unable to see the ground from 700ft; nevertheless, he managed a fast bank-to-bank rock-past with camera doors open. A production-type camouflaged Hunter 1 was then off the mark in such an eruption of sound that it seemed hardly credible that only half the thrust of the Canberra was responsible.

For a real sepulchral Wagnerian fulmination, however, Bristol's Olympus-Canberra is supreme; and to an awesome diapason it now lunged forward as the throttles were—quite literally—slammed open. A matchless combination this, with not only the world's height record to its credit, but the ability to relight the Olympuses at any height up to 55,000ft, and to accelerate from idling to full thrust in under 3 sec. It reared up on its great jets and leaped into cloud at an astounding angle.

A Sea Hawk having shown its shapely self a little coyly, the black-and-grey Canberra in which Armstrong Siddeleys are try-



The three lower photographs, reading clockwise: Bristols' Proteus Ambassador, very trim in green, silver and white; the same aircraft cheering a damp crowd on technicians' day; and a domestic scene—Shorts' second Seamew awaiting its ground crew.

(Top) A newcomer this year is Fairey's Gannet T.2; (above) XA544, a production Javelin F.A.W.1; (right) the Jet Provost disports at 10,000ft.

FARNBOROUGH '54 . . .

ing out their mighty Sapphire 7 discharged itself into the sky. Here, without doubt, is a rival to the Olympus test bed, though its ascent to cloud oblivion was a shade less spectacular.

A sequence of helicopter demonstrations now made a happy interregnum in the succession of sound and fury; and never were the qualities of rotary-wing aircraft more vividly demonstrated, for while the fixed-wing machines were more or less frustrated in their endeavours by the pendulous clouds, the Bristol 173 and Sycamore 4, and Saro Skeeters 5 and 6 stepped unconcernedly into the air in a gay flurry of blades. Most impressive on its circumambulations was, of course, the 173, flying this year without its wings, having regard to its future employment in the anti-submarine rôle. Of the Skeeters, the 6 commands the greater power, though the 5 seemed almost as sprightly, possibly because its C. of A. may be imminent.

And so this radio-controlled wonder of a display went forward unchecked, with the lanky Meteor N.F.14 followed by the Navy's new Gannet T.2 trainer, wherein the Mambas were handled, one fancied, with a real Naval telegraph. (And was the pilot glad to ring "finished with engines"?).

Short's twin-Palas aero-isoclinic Sherpa took its time unsticking, but orbited tightly to show the beauty of its plan-form and the effectiveness of its unorthodox control surfaces.

For the first time at any public display in Great Britain Hunting Percival's Jet Provost rose to show its calibre; and a short, quick rising it was. The stilty legs were tucked away in a twinkling, and this successor-apparent to the piston-engined Provost (which will, of course, hold its envied place for years to come) came round for an exhilarating sequence of rolls. Here is a lively, practical aircraft in the Hunting Percival manner.

With its underslung gun pack, bomb pylons and offset canopy, the English Electric Canberra B.8 is the very epitome of bold intrusion, just as its demonstration represented the acme of quality and skill. The Avons thundered, the wheels were off and up, and the Canberra was wheeling round steep and low, half veiled in shimmering vapour. Always it was close in view, always changing course or attitude, always bespeaking superb control and consummate skill.

The two Short Seamews, of course, took the weather in their stride, and their uncompromising utilitarian shapes added piquancy to their frisky performances. While one was rolling with gay abandon, the second was whirring and whining along at something like destroyer speed.

Now came the moment for the debut of the Folland Midge—a moment filled, for many observers, with significance and pleasure, for here was something not just new but absolutely novel. It was not that thought alone, however, that sent a glow through British observers; nor, for that matter, was it the saucy eye-appeal of this little blue beauty. It was, we suspect, the knowledge that here was the substance of an Englishman's cherished dream, brought to reality by imagination and skill in face of antipathy, if not downright discouragement. Imagine, then, the disappointment which swept through the crowd when it became known that the Midge would not, after all, be taking off to flaunt its aggressive little form in the glowering face of the weather.

But the puissant Avro Vulcan being soon aloft (leaving a wake of spray and toppling photographers), there was no time for regrets; time only for admiration of its pilot's determination and—let us say it—courage. Sheerly banked, the prodigious white delta ranged round the leaden sky, enrobed in silver vapour, before approaching in an S-turn, and touching down with the haughty majesty of its kind.

The assembly had by now been richly rewarded for its discomfiture, and there was no surprise when it was learned that the Fairey F.D.1, Vickers-Supermarine 525, Comet 2, D.H.110 and Gloster Javelin had withdrawn from the flying programme. Our story of this memorable afternoon, however, is not yet at an end, for we now have to record a performance of singular spirit and dash. We have not hitherto named the pilots concerned, for there was occasionally doubt as to their identity, and they are, in any case, portrayed on pages 409-411. Here we make an exception, in the knowledge that no one will resent it, least of all the fellow test pilots of the man concerned. He is Dave Morgan and his mount was a Swift F.4. Time and again he sent this camouflaged production machine full-drive across the field at his minimum height. At length, rolling low into cloud, he left behind him a glow like that of his afterburner.

Sou'westers off, then, to Dave Morgan, though he was not alone in the high-speed, low-level business, for out of the gloom shot a green dart from Dunsfold, in the form of the mysterious "Hunter variant" or "Mk 6." And if we do not describe such features as may have differed from standard, we make no apology, but refer the inquisitive reader to a picture on page 400.

The beauteous Hunter has been likened to many things, but never, to our knowledge, to a locomotive, though distantly seen across the field the Sapphire-powered Mk 2 appeared as such as it opened up, with great jets of vapour spurting from its fuselage vents. This version, too, raised the Hawker flag into the air, and

(Left) The interior of the Herald mock-up, showing the pantry; (right) Ronald Porteous up in the Bombardier-powered Auster A.O.P.9 and an air-to-air study of the Rolls-Royce Soar-Meteor.

(Left) The D.H.110 breaks away under the power of its high-mounted all-flying tailplane; (top) Jim Cooksey gets rolling in the Meteor N.F.14; (above) Brian Trubshaw arrives at Farnborough in the black Valiant B.2.

for the first time in public displayed the new air-brakes at close quarters.

Finally, the great Comet 3 turned on to the runway, opened up and sailed into the air like a clipper ship, tacking and turning with a majesty all its own.

And, as Oliver Stewart reflected from his lofty eminence, anything further would have been an anticlimax.

AIRCRAFT ON SHOW

Armstrong Siddeley Sapphire-Canberra. Although Armstrong Siddeleys are not able to display a Sapphire 7 in the static exhibition, two of these mighty axial-flow turbojets have now been fitted to their Canberra test-bed WD 933 and we have it on the company's authority that this is the most powerful Canberra ever to take the air. Each Sapphire is housed in a slightly bulged cowling, with top and bottom access panels on each side hinged on the upper and lower centre lines; as far as we can judge the jet nozzle diameter is 22in. Synthetic oil type OX-38 is specified, and the Sapphires are fitted with 120-volt electric starters.

Auster Aiglet Trainer. Bright red, and white trimmed, G-ANYI, the demonstration Aiglet Trainer which Ranald Porteus has flown at many air displays over the last few months is designated the J.8L, and is a short-span Aiglet variant with a Gipsy Major 10 engine. Auster pilots will note the central overhead flap lever and the port-side trimmer—a reversal of previous Auster practice. Those who have seen Porteous in action will need no reminding that this is a fully aerobatic machine: it is proving very popular as a civil and military trainer in sixteen countries.

Auster A.O.P.9. This spritely new Air Observation Post appears at Farnborough for the first time this year. Powered by a Cirrus Bombardier 173 (capable of running on ordinary motor fuel) the A.O.P.9 has a wider fuselage and much modified structure, compared with previous Austers. The aircraft shown is WZ 664, the third production aircraft. It is fitted with the rear fuselage strakes now standard on the type.

Aviation Traders Accountant. On the visiting-list of many airline executives is Stand No. 102, where Aviation Traders are dispensing latest news of their twin-Dart DC-3 replacement. Models illustrate three typical versions of the Accountant—a 34-seat airliner, a luxurious nine-seat executive transport, and an ambulance for 13 stretcher patients.

Avro Vulcan. The first-ever opportunity to inspect a Vulcan —VX770, the Sapphire-powered first prototype—is a special draw at this year's Show. Impressive at a distance, the Vulcan inspires awe at close quarters. Early-comers on Monday were rewarded by a glimpse of the open bomb bay, wherein hung a large fuel tank. Also open was the compartment for the braking parachute, placed asymmetrically on the starboard side of the tail-cone and level with the rudder trailing edge. The air brakes consist of eight rectangular panels, disposed in pairs above and below the wings; each panel is mounted on two arms and, during retraction, turns through 90 deg to fold flush with the wing structure. Added braking effect is provided by the rear doors of the main undercarriage and, of course, by the massive Dowty units themselves. The all-enveloping white skin of the Vulcan is extremely well finished and smoothly contoured, and external examination leaves much to be imagined.

Avro Shackleton M.R.2. The Shackleton 2 is on view in the static park this year and is a standard example of the type which is now the backbone of Coastal Command long-range reconnaissance squadrons. All Shackletons of this mark are now being fitted with twin 20 mm cannon in the nose.

Blackburn Beverley. Looming over all in the static park is the prototype Beverley, which has lately been fitted with a new centre-section enabling the 14ft airscrews to be replaced by new D.H. hollow-steel airscrews of 16ft diameter. Take-off performance should benefit considerably. The Beverley arrived on Saturday carrying nothing less than a factory—a 12-ton mobile plastic-pipe producing unit self-contained in its own trailer; the carriage of the necessary raw materials and construction crew would bring the payload in this instance to a total of 22 tons. Displayed hard by the aircraft is a representative military load, consisting of a 25-pounder gun and a one-ton combat truck fully rigged for air dropping. News from the Brough production line is encouraging, and Beverleys should be in Service hands before a twelvemonth has passed. Beverley flying hours totalled 166

Barry Radley hangs on the tail of the photographic aircraft in the Burmese Hunting Percival Provost T.53 (Armed Provost).

FARNBOROUGH '54 . . .

by Monday, with a further 398 hr to the credit of the original Hercules-powered Universal.

Boulton Paul Balliol. The company's demonstrator, painted maroon and cream and registered G-ANSF, is being flown this year. Except for its colouring it is a standard trainer.

Bristol Freighter. Camouflaged in olive-green and grey, with blue under-surfaces, the statically displayed Type 170 Mk 31E looks every inch a trooper. It is destined for Pakistan, and bears the serial G-18-166; the prospect of a delivery flight *via* the Middle East may explain the lack of military insignia. The nose doors are glazed for downward vision, and above the sill is a 20 cwt Vickers-Armstrongs loading winch. Alongside the fuselage walls are 30 collapsible paratroopers' seats with canvas ditching-shrouds; points to be noted aft are the astrodome and a fairing which prevents parachutes from fouling the tailwheel.

Bristol Britannia. Sunday afternoon brought news that the first production Britannia for B.O.A.C., G-ANBA, had made a 45-min maiden flight at Filton. "Bill" Pegg was the pilot. The flight-testing programme has priority over demonstration, and only on "transport day"—Thursday—was the new Britannia scheduled to appear at Farnborough. Worthy of close attention are three fine Britannia models on Bristol's stand, one in S.A.S. colours. The Scandinavian airline is known to have drawn favourable conclusions from its recent technical appraisal of the Britannia, although discussions have not yet reached the contract stage. The model in question shows the 300L.R. Britannia as equipped to operate the transatlantic "Royal Viking de Luxe" service.

Bristol Olympus-Canberra. Proud bearer of the legend "Holder of the World Altitude Record, 63,668ft," the Olympus Canberra shows no noticeable changes this year. Engine handling clearly remains superb, as is described in the report of the flying.

Bristol Proteus-Ambassador. To distinguish it from sister ships in service with B.E.A., Ambassador G-AKRD has a smart new colour-scheme, with white top and green trimmings. There is, however, a more significant distinction: the installation of two Proteus 705 power plants, as produced for the Britannia 100, together with Britannia-type instrumentation. As in the Mamba-Marathon, the jet pipes are swept over the wing to exhaust aft of the trailing edge. The Proteus-Ambassador had logged 150 engine-hours at the start of the Show, and intensive trials will be resumed immediately afterwards. It is solely a test-bed intended to amass additional experience of the Proteus prior to the Britannia's introduction to B.O.A.C. service, and Bristols emphasize that there is no question of fitting these engines to other Ambassadors.

Bristol 171. The 171 on show is G-AMWI, the machine which appeared at Farnborough last year. Between its quickly removable Perspex side-blisters two stretchers are fitted—and, on the starboard side, a rescue winch. The winch on the standard Sycamore Mk 4 is in practice normally removed when the helicopter is used for ambulance duties. The expected Sycamore Mk 14 did not appear.

Bristol 173. Looking at where the stub wings are not, on this year's 173, one recalls the company's statement that "where the helicopter is mainly required to hover—as in the anti-submarine rôle—there is no need for wings." The vee-finned example shown, XH379, is presumably externally representative of those Naval twin-engined helicopters now on order; a glance inside it, however, shows but four seats, two a side, in the centre of the fuselage. On the Bristol stand in the exhibition tent is a model of a civil-type 173, the stub wings of which are designed partially to unload the rotors in cruising flight. The 173 prototypes are powered by the Alvis Leonides engines; initial production versions will use the more powerful Leonides Majors.

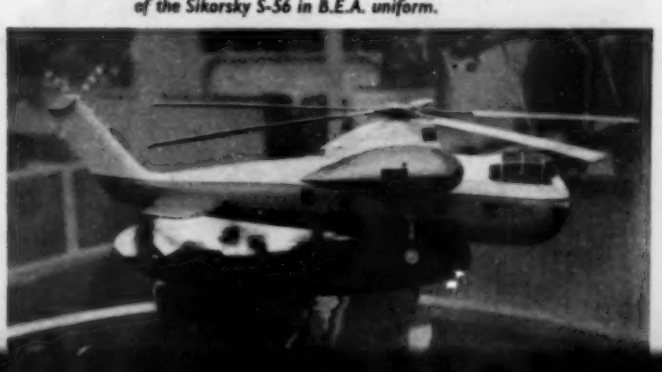
de Havilland Venom F.B.4. Shown statically, the single-seat F.B.4 is possibly the fastest de Havilland aircraft in service, and has powered ailerons which give good control close to sonic speed. Revised fins are associated with the full-span tailplane, as illustrated on p. 401.

de Havilland Venom F.A.W.21. The de Havilland Sea Venom F.A.W.20, already in squadron service with the Fleet Air Arm, will later be replaced by the F.A.W.21, which incorporates a number of modifications. These include, in particular, the fitting of powered ailerons of increased area, which give considerably improved control both at low speed and at high Mach numbers.

de Havilland Vampire T.11. Together with the Provost, the Vampire T.11 makes up the team of aircraft in the new R.A.F. training syllabus. Several R.A.F. stations are now fully equipped with T.11s. Normally used in the R.A.F. purely for advanced training, the aircraft also carries two or four 20-mm cannon and gyro gunsights for pupil and instructor.

de Havilland D.H.110. Still the second prototype of this design, numbered WG 240, the D.H.110 seen at Farnborough has undergone considerable modifications in the past year. It is now fitted with an all-flying tail, the elevator being purely a trimming surface actuated by high-speed trim-jacks. The fins and rudders, also, have a somewhat different outline. The upper and lower extremity of each fin has been modified to take, respectively, the new tailplane and a reinforced bumper skid; it was apparent that the latter had already fulfilled its function. The wing fences have been increased slightly in size, and the leading edge of the wing outboard of these has a permanently drooped "snoot." The ailerons are mass-balanced, and each is fitted with a position indicator for tests of combined aileron "creep" during high-speed flight. The observer has an extensive range of flight test instruments. A model with folding wings is shown.

de Havilland Comet 2 and 3. In keeping with their respective rôles as "partners for the medium-stage and long-stage trunk routes of the world," the Comets 2 and 3 are displayed in complement. The Comet 2—G-AMXD, fourth machine to be completed for B.O.A.C.—is, inevitably, overshadowed by G-ANLO, the Series 3 prototype. Like its stable-mate, the Comet 3 is now finished in full B.O.A.C. styling, although the silver portions are painted, rather than polished, metal. On Monday a few privileged guests were admitted to the lengthy cabin, which has been fully furnished as a luxurious 58-seater with B.O.A.C. blue-and-grey *décor* and the new D.H. lightweight double seats. To the right of the entrance door are toilets and a rear freight compartment supplementing the forward underfloor hold. A central bulkhead divides the two main compartments and prevents "tube effect." The flight deck is in most respects similar to that of the Comet 1 and 2, and there is a small amount of test equipment forward of the galley. To date



(Left) Napier pilots Randrup and Cartwright bring the 6,000 h.p. Eland-Varsity across from Luton; (below) a Westland exhibit—a model of the Sikorsky S-56 in B.E.A. uniform.

Claimed by Armstrong Siddeley to be the world's most powerful twin: the Sapphire 7 Canberra.

the prototype has flown some 20 hr, and is being operated without pressurization, as is usual in the initial phase of flight-testing.

de Havilland Heron. Orders for this 14-17-passenger transport are steadily climbing to the century; the machine in the flying display is TC-HAK, one of seven Heron 2s now replacing DC-3s with D.H.Y. Turkish airlines.

de Havilland Dove 6. By virtue of its record as the best-selling British civil aeroplane, the Dove has richly earned its unbroken series of appearances at all post-war S.B.A.C. displays. This year the breed is represented by a neat Dove 6, registered G-AMZN, painted white, green and silver, and luxuriously appointed as a six-seat executive transport.

de Havilland Chipmunk. One of the company's demonstration machines, G-ALWV perches trim and shiny on the static-park runway, showing off its new yellow plaid fuselage flash.

de Havilland Beaver 2. Statically parked, the Leonides-powered Beaver 2 G-ANAR carries grey and olive green camouflage, blue under-surfaces, and a brace of bright red supplies-containers (later shed for the flying) on its under-wing mountings. Interior arrangement of this particular machine accommodates three seats and two stretchers in addition to the pilot.

English Electric Canberra B.8. Surely the most aggressive Canberra yet produced for the R.A.F., the B.8 is also the most easily identifiable. It follows the tradition of the B.6 and P.R.7 in having the higher powered Avon with a standard wing and tail. The nose is completely new, with a very large bubble canopy offset to port for the pilot and a single crew-position forward. The bomb-aiming position is along the fuselage centre-line, with a centrally mounted window for the bomb-aimer; superimposed over this, and presumably removable in flight, is a rearward-facing seat with the weapon selector switches and other gear ranged round it. While the pilot has a standard automatic ejector seat, the crew escape from the normal door to starboard; to facilitate this a small wind-breaker door can be opened immediately ahead of it. A further large door on the starboard side is marked as an equipment-access hatch.

The weapons installation obviously allows for a large variety of offensive stores, either mounted on wing pylons just outboard of the engines, or in the very long bomb-bay, the rear section of which houses a gun-pack. Yellow covers over the ports suggest the fitting of four Aden guns. Immediately aft of the bomb-bay is a camera compartment.

English Electric Canberra B.6. A standard silver Canberra B.6 is on show in the static park. This version has higher-powered Avons with triple-breeched starters, but retains the shorter fuselage of its predecessors. Its additional power, however, evidently gives it considerably improved load-carrying ability, as may be surmised from the wide variety of bombs ranged around it. The crew compartment and other arrangements are not substantially different from those of the B.2.

English Electric Canberra P.R.7. The photographic Canberra P.R.7 was first announced last October. It has higher-powered Avon engines and a lengthened fuselage which allows greatly increased fuel tankage, better performance and greater range, all important factors in a machine of this type. Stowage is provided for a wide variety of cameras, both oblique and vertical, and such items as flares in a small bomb-bay level with the wing trailing-edge. This new machine should extend even further the already considerable range of the R.A.F.'s reconnaissance squadrons, which are the indispensable eyes of the striking force.

Fairey F.D.1. Although its first flight was in March 1951, this diminutive delta has not previously been shown in public. Monday's visitors showed particular interest in the ingenious retraction geometry of the main wheels, which fold back into the barrel-like fuselage. Below the Nene tail-pipe outlet is housed a drogue-type braking parachute; above, a pointed fairing. Small cylinders at the tips of the 19ft 6½in wing contain anti-spin parachutes. Control surfaces are a rudder and elevons with servo-tabs; inboard of the elevons are small flap-like speed brakes.

Fairy Gannet. Three Gannets are on view at Farnborough. One, WN360, proudly sits astride a nest of mines, bombs, flares, rocket projectiles and other warlike ironmongery, while some distance away are parked a sister A.S. Mk 1 (WN391) and WN365, the new T. Mk 2 trainer version, both of which take part in the flying display. The trainer version carries no radar-scanner "dustbin": only other external difference apart from the paint scheme appears to be the deeper cable-run fairing on the port side of the fuselage just below the canopy. Some 75 per cent of the Gannet's normal A.S. equipment is carried in the trainer, the example displayed being the first of a number on order.

Fairey Firefly 8. With an airframe identical with that of the Firefly 7 three-seat crew trainer, the Griffon-powered Mk 8 Firefly is a multi-purpose aircraft which can be used in both piloted and radio-controlled forms. The most notable superficial features of this aircraft are the cylindrical wing-tip pods, each of which carries five cameras surveying the entire field about the aircraft. Obvious applications include missile development and examination of atomic explosions or anti-aircraft fire. The aircraft shown in the static park (WM882) is finished in the standard colour scheme for pilotless targets of cream above and red below.

Folland Midge. The Midge—with its Viper rated at 1,400 lb thrust—is a spectacular precursor of the Gnat. These facts are indicative of its qualities: by September 6th it had completed 18 hours' flying, and in that time had attained 0.95 Mach in a shallow dive with no trouble; in level flight it attained 450 kt. At this speed a strong push on the stick produced a rate of roll of 108 deg per second, and 6.5g can be applied without significant trim change. It can be "rolled off the top" in 2,500ft. The undercarriage door dive-brakes are so phased as to avoid trim change on extension, and will decelerate the aircraft from 450 kt to 180 kt in about one mile. It has remained controllable at 86 kt. The Midge is so small that, air-to-air at 800 yd, it is virtually invisible; opposing fighters would have no time, therefore, to fire at it in the time available after sighting.

Gloster Javelin. No fewer than five Javelins were on hand at the beginning of the week and all of them were to demonstrate in formation on Tuesday. Of the five, two (XA 544 and 546) are of the first production batch, two are development prototypes and the fifth is the company's fourth prototype. This latter aircraft, fitted with a long nose probe, has been sonic in a shallow dive on several occasions. The whole cockpit enclosure is new, consisting of two separate sliding canopies with a fixed bridge, each section fully transparent.

The four Aden guns are mounted in the wings, well back from the ports, and only case-ejection tubes are to be seen; the links are presumably collected and retained. There are fittings for a very large ventral tank, probably capable of holding close on a

Two rear-loaders: the Blackburn Beverley (right) with its load, and the Scottish Aviation Twin Pioneer development.

FARNBOROUGH '54 . . .

thousand gallons. Access for the crew is via recessed steps in the port side of the tail, aft of the wing.

Gloster Meteor 7/8. Not "seven-eighths" but "seven-eight" is the maker's designation of this "private venture two-seat trainer built under M.o.S. contract" (to quote the machine's seemingly contradictory name-board). Bright blue and trimmed in cream, G-ANSO is basically a ground-attack Meteor but with the tandem two-seater cockpit of the Mk 7. It carries an underbelly fuel tank and also tip tanks, vertically finned front and rear, the front fins being inclined outwards.

Gloster Meteor N.F.14. The Meteor N.F.14 is the latest and probably the last of a long line of Meteor variants. Adapted by Armstrong Whitworth as the night fighter carrying the latest A.I. gear, it has a wing of increased span with long-span ailerons and spring tabs, additional flap outboard of the engine nacelles, four 20 mm guns in the wings, 100-gal under-wing tanks, wide intakes and increased fin area. An entirely new cockpit canopy has been designed, a fully transparent sliding assembly with a new wide windscreen. No ejector seats are provided. The N.F.14 has a performance better in many respects than that of any other Meteor, particularly in manœuvrability at medium altitudes, and is already in squadron service in considerable numbers.

Handley Page Victor. During the early part of the week, the second Victor, WB775, was undergoing final checks before beginning its flight trails at Radlett with a view to a Farnborough visit later in the week. We understand that it carries full operational equipment.

Handley Page Herald. Situated immediately inside the main entrance to the static tent, the mock-up Herald fuselage draws a steady flow of interested technicians and airline men. The cabin is most convincingly laid out for a mixed load of passengers and freight. In the after cabin are 24 seats, the majority rearward-facing; the cargo compartment has 4,370 lb of payload, and baggage is stowed in a spacious rear hold. In this form the Herald would cover a 440-mile stage in 2 hr 38 min.

Hawker Hunter 6. Previously referred to simply as a Hunter variant, it was revealed at the show that the variant was in fact the Mk 6. Finished in the duck-egg green of its predecessor the P.1067, it showed, in a fleeting glimpse during a high-speed run in very poor visibility, no immediately noticeable outline changes. It can be presumed, however that it is fitted with a Rolls-Royce engine with a thrust going well into five figures. The externally applied airbrakes of other variants were in evidence. It is also to be expected that the larger engine will require additional fuel tankage.

Hawker Hunter F.1. Now to be seen in increasing numbers over Britain, this fine fighter should soon reach the squadrons; very large numbers have already been built, and most have been fitted with an airbrake under the rear fuselage and finished in the new Fighter Command camouflage. Some machines are to be seen with ammunition-link collector boxes beneath the gun-pack. Refuelling points, powered-control linkages and pressure accumulator are grouped along the dorsal spine. The gun pack can be lowered from the fuselage with the aid of cables suspended from mountings in the fuselage side. Electrical and radio gear is in a compartment immediately behind the gun pack. De-icing fluid for the windscreen is held in a small tank in the nosewheel bay. There is a connection for cooling of the radar equipment during ground testing.

Hawker/Armstrong Whitworth Hunter 2. Powered by the Armstrong Siddeley Sapphire, the Hunter 2 is being produced in large numbers by Armstrong Whitworth. Externally there is practically no difference between this and the Hunter 1. A combination of rear view mirror and extensive transparencies on all Hunters would appear to give excellent rearward visibility, without which fighter-to-fighter combat has always proved most dangerous.

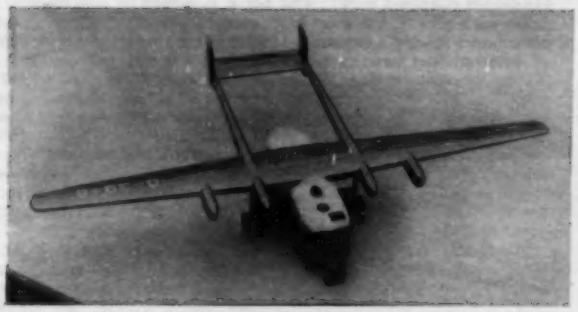
Hawker Sea Hawk. Carrying the serial WN107, and the makers' insignia in lieu of a squadron badge, the spruce Sea Hawk in the flying programme is a standard Mk 3 fighter/bomber with boosted ailerons.

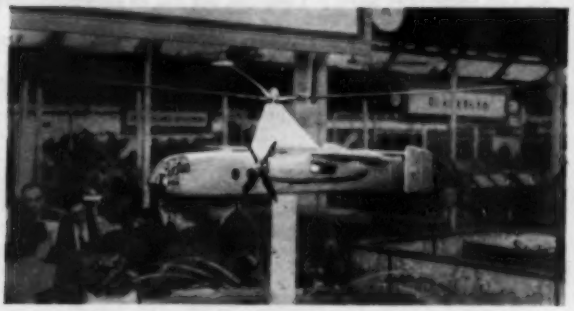
Hunting Percival Provost 53 and Mk 1. The Provost Mk 1 is already well established in the R.A.F. as a basic trainer and has now replaced the Prentice. Side-by-side seating, outstanding handling characteristics and high power mark a new departure in basic trainers. The Mk 1 is on show in the static park.

A variant, the 53, the first of several destined for the Burmese Air Force, is being demonstrated in the air. It carries two fixed 0.303in machine guns in the wings and a variety of rockets and bombs under them.

Hunting Percival Pembroke. Two Pembrokes are on show, a standard R.A.F. C. Mk 1 (WV733) fitted with eight rearward-facing seats, and the eighth machine of the survey series built for the Belgian Air Force. This latter machine, which is the

(From the top) Swift F.4 WK 273 with representative weapons; Bristol 173 development aircraft with short stub wings; Bristol Sycamore 4; Scottish Aviation Twin Pioneer; and the new Pioneer 4.





(Top) The military Bristol 170 Mk 31, fitted with folding seats; (below) Folland light transport project and Fairey Rotodyne.

one demonstrated in the flying display, carries the registration OT-ZAH, and its equipment includes four cameras: one oblique type in the transparent nose, and two obliques and one vertical inside the fuselage. Among the Pembroke cutaway models on the Hunting Percival stand was the ten-passenger version for the Swedish Air Force.

Hunting Percival P.74. The model of the eight-seat P.74 helicopter which appeared at—and disappeared from—the Percival stand last year is again on show in the Exhibition tent. There is, however, no M.o.S. restriction on its appearance this year. The model's fuselage shape is different from that of the actual prototype machine, which should be flying next year. The two Napier Oryx turbo gas-generators which form the power unit are to be situated, side by side, beneath the floor of the forward half of the cabin.

Hunting Percival P.87. Little new concerning Hunting Percival's Dakota replacement is obtainable from the company's stand, and no model is on show. We understand that the project is still in the design investigation stage, with a number of alternative power units—possibly four Oryx—under consideration.

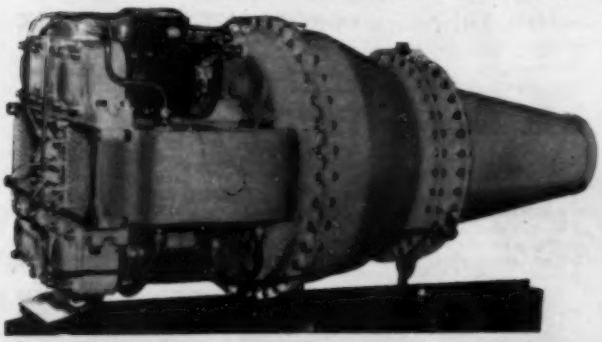
Napier Eland-Varsity. This is a standard production Varsity (VX835) used by D. Napier and Son, Ltd., as a test bed for the 3,000 h.p. Eland turboprop. Unfortunately the existing firewalls, tailored to the dimensions of the engines originally installed, have made it impossible for the optimum Eland cowling to be realized.

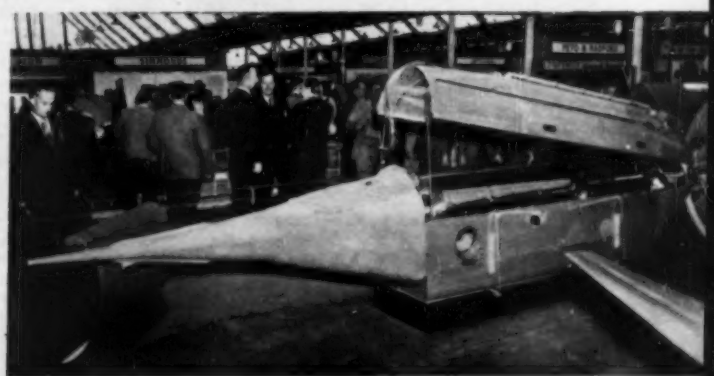
Rolls-Royce Soar Meteor. The Rolls-Royce Soars fitted to the tips of Meteor 8 WA982 are incredibly small by any standard. Each engine is attached directly to the wing-tip without any cowling, lending support to the suggestion that the engine is a structural and aerodynamic body in which the main shell of the engine acts as the wall of the gas path and the outside cowling. Behind the plain diffuser intake four support struts can be seen mounted tangentially to the intake cone (as in the Avon) to accommodate expansion movement. Curved guide vanes can be seen immediately advanced of the first compressor stage, all blading seemingly being of aluminium bronze. The tail bullet is supported by seven radial struts and, in the Meteor installation, no starter is visible, although this may be a compressed-air jet lying within the tip of the wing. Numerous electrical connections for the ignition and thermocouples are visible. Each Soar can be covered by a long pressed light-alloy cover which slides on to the intake.

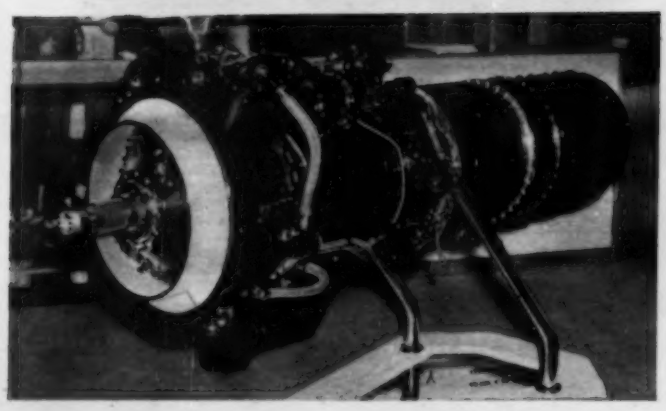
Saunders-Roe Skeeter. This year there are two Skeeters on show: the blue-nosed, white-boomed Mk 5, just back from a demonstration tour of Germany, and the maroon-nosed newcomer, the Mk 6. Power plants and registrations are, respectively, Bombardier 702, G-AMTZ; and Gipsy Major 30 Mk 2, G-ANMH.

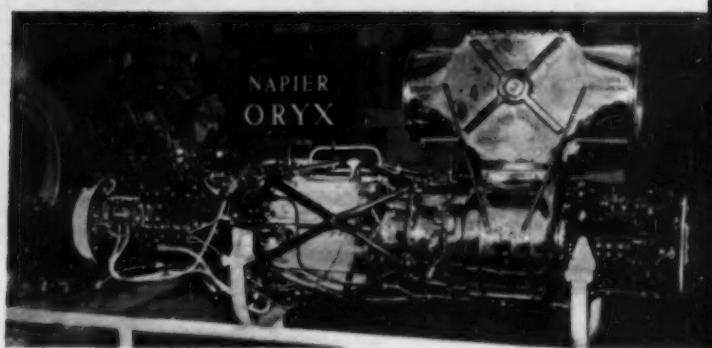
Scottish Aviation Pioneer. The Pioneer taking part in the flying programme, G-ANRG, is the latest to come from the pro-

(Clockwise from bottom left) Armstrong Siddeley Mamba 5 with annular chamber; Blackburn Turboméca Palas 600; de Havilland Super Sprite rocket pack, showing the long nose cone which transmits the thrust; and the Napier Oryx turbo gas-generator.









FARNBOROUGH '54 . . .

duction line at Prestwick. A five-seater, it is essentially similar to previous Pioneer 2s shown at Farnborough, and to the four now serving with the R.A.F. in Malaya. A model in the big tent gives the first news that the makers have plans for a more capacious (and, incidentally, more handsome) Pioneer designated Mk 4. This retains the 550 h.p. Leonides, but has an altogether fatter fuselage with ten seats, including side-by-side pilots' seats.

Scottish Aviation Twin Pioneer. While the prototype Twin Pioneer is not expected to fly for another two months or so, a model in the static exhibition illustrates the main features of this 16-seat light transport. Nearby is a model of the proposed military variant, a trooper/freighter with clamshell rear-loading doors and a four-wheel undercarriage reminiscent of that of the Auster Ambulance/Freighter.

Short Sherpa. Making its first appearance at Farnborough, the diminutive black-and-silver Sherpa attracts much attention. Those inspecting it literally look down on it, for the top of the fuselage is no more than shoulder-high. When on view in the aircraft park its two wing-tip elevons point earthward at a most improbable angle: further details of the elevon-operating mechanism can be studied in the Exhibition tent, where on the Short stand is a 4ft 6in cut-away model of the Sherpa wing.

Short S.B.5. This experimental aircraft has now completed its trials with 60 degrees of sweep and will shortly be returned to Boscombe Down, where a wing with no less than 69 degrees sweep will be fitted—a greater sweep angle than has ever before been flown with a piloted aircraft. This Derwent-powered machine has appeared this year with a camera fitted on each side of the fin to examine air flow over the outer wings, the outer port wing being tufted.

Short S.B.6 Seamew. Two prototypes, XA209 and 213, one painted silver and one in Naval colours, are being demonstrated in the air this year. The type is intended as a lightweight and inexpensive anti-submarine aircraft capable of operating from light carriers or unimproved air strips with the latest anti-submarine weapons. It carries a crew of two in tandem, an "Adam's apple" radome immediately forward of the long, narrow weapons bay, and this year has small slots midway along each wing and what is known as a "vented fillet" at the tailplane fin intersection. Seamews are in production for the F.A.A.

Sikorsky S-56. Arousing considerable interest on the Westland stand is the model of the American twin-engined Sikorsky S-56 in B.E.A. markings. Although no definite announcement of future Westland manufacture of this machine has been made, it is known that the company has plans for several turbine-powered types of helicopter for civil and military use in the future.

Vickers Valiant B.2. This great black-painted aircraft differs considerably from all other Valiants and is at present a purely experimental machine. Powered by four late-model Avons, the Valiant 2 has a rather longer nose than the production B.1 and, if the bogie undercarriage is any criterion, can operate at a considerably greater all-up-weight. Recent aerodynamic modifications include the fitting of numerous vortex generators on the tailplane and on the fin above and below the tailplane to transfer energy from the boundary layer to the free airstream and so improve control and reduce drag. Each generator is a plain sheet approximately 5in chord by 1in span set at approximately 20 degrees to the airflow. Dielectric surfaces occupy much of the lower rear fuselage and fin tip and additional transparent areas in the roof of the cockpit should prove useful in tight turns.

Vickers-Armstrongs Viscount. Britain's "aircraft of the year" is so much in demand that only one example (VH-TVA *John Batman*, the first of six Viscount 720s for T.A.A.) could be spared to appear on one day—Tuesday. *John Batman* arrived in the rain on completion of Monday's flying programme, very smart in white, red and blue. Yet another order was announced on Friday, by Braathens S.A.F.E. of Norway, bringing the total of Viscounts sold to 154; there are options for a further 20. Models on the Vickers-Armstrongs stand show the colours of all 18 customer-airlines; also shown in model form is the Viscount 800, which will have a 46in fuselage "stretch." Viscounts in service with B.E.A., Air France and Aer Lingus are now amassing flying hours at the rate of 1,200 weekly.

Vickers-Supermarine 525. This large twin-Avon experimental aircraft represents an interim stage in the development of a supersonic, single-seat, carrier-based attack fighter for the Royal Navy. Developed directly from the Type-508 and 529, the Supermarine 525 has swept wings and tail surfaces. The bullet fairing the tail parachute is attached to the tailplane and tilts with that surface. Beneath the tail are a pair of large doors covering the stowed arrester hook, forward of which is a large tail bumper. The wing is not arranged to fold and has large ailerons, small plain flaps and gate-type speed brakes above and below the inner wing. The main undercarriage is fitted with large single wheels with 37 × 10.00-19 tyres, which retract into the fuselage belly. The Avons are not fitted with reheat although numerous auxiliary air intakes are visible on the fuselage decking.

Vickers-Supermarine Swift F.4. The first fully equipped production model Swift, the Mk 4 is to be seen this year in camouflage paint, both in the static park and in the air. The example in the static park carries a 1,000 lb streamline bomb under one wing and eight 60 lb rockets under the other (for exhibition purposes only). The Mk 4, powered by a Rolls-Royce Avon with reheat, has four Aden guns, a variable-incidence tailplane, and Maxaret brakes. Markings on the fuselage indicate an internal fuel tank of no fewer than 778 gallons' capacity—500 in the rear fuselage, 98 behind the cockpit, and 90 in each wing root. Detail differences between prototype and production machines show the latter as having a taller fin and rudder and no access steps; presumably a portable ladder is now used. The cockpit canopy appears to restrict rearward and upward vision considerably, due to a metal rear section and vertical pressure-bulkhead and a wide metal "spine" along the top. A look past the adjustable jet-efflux eyelids affords a view of the concentric flame-holders of the afterburner.

Westland-Sikorsky S-55. In the static park a Naval S-55 Whirlwind, XA871, stands with clamshell doors agape—the better to display its clean new Alvis Leonides Major. Winch gear is fitted, while inside its cool green interior are visible (through a transparent sheet) one backward-facing seat and two stretcher-type benches seating three, one bench on each side. The machine is depicted, its notice-board informs us, in the "rescue and replenishment" rôle. Inside the Exhibition tent appears a white giant in the form of R.M.A. *Sir Ector*, G-ANFH, B.E.A.'s first S-55—minus tail boom, rotor blades and engine, but otherwise giving a good indication of what British airline passengers may soon expect. Three forward-facing and two rearward-facing seats are fitted, with baggage space in the foremost section of the cabin. Without flotation gear, eight passengers plus baggage can be carried. The inside wall plaque sounds a warning note: "The good *Sir Ector*," it reads, "should not be confused with *Sir Ector de Maris*, brother of the great Sir Lancelot."

THE STATIC SHOW

IF ever there was an indication of the growth of the British Aircraft Industry's strength it is amply provided by the Farnborough static show. This year, the ground exhibition has burst at the seams, so to speak, for the vast marquee, of no less than 100,800 sq ft area, has—as we report on an earlier page—been re-positioned at the top of the hill on the south side of the airfield. The site is reached by a gentle climb up an imposing terrace, between lofty poles bearing the flags of the British Commonwealth.

A number of the products and projects displayed on the 292 stands were referred to in our last week's issue; next week we shall record the results of a personal inspection. This will, of course, include notes on several power units displayed for the first time.

SHOW DINNER : IMPORTANT DISCLOSURE

LAST Monday evening, following the rehearsal for the Farnborough air display, the dinner of the Society of British Aircraft Constructors was held at the Dorchester Hotel, London. As in previous years, the huge ballroom was packed to capacity by guests from almost every country outside the Iron Curtain.

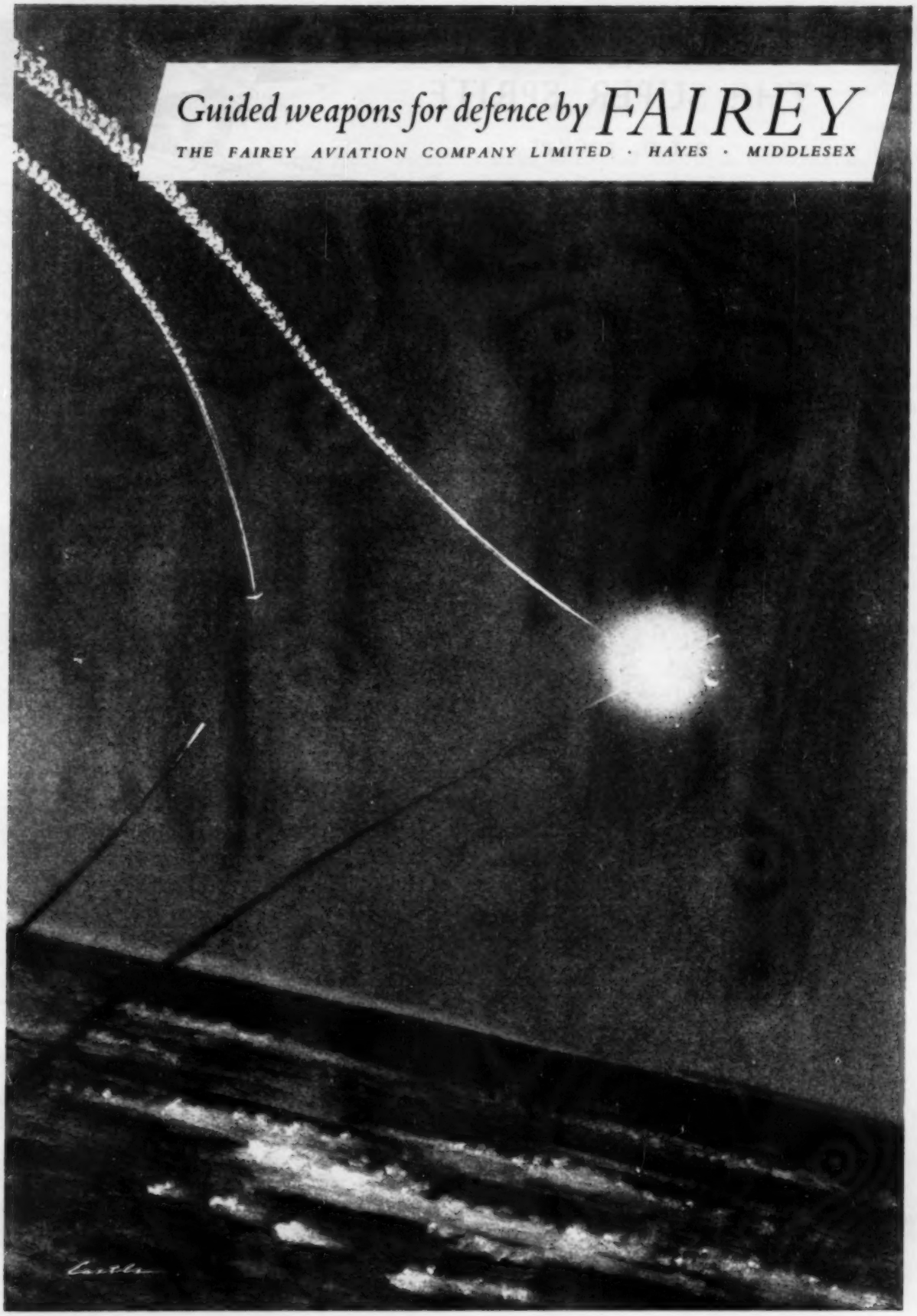
The toast of "The Guests" was proposed by Mr. J. J. Parks, chairman and managing director of Alvis, Ltd., who is this year the president of the Society. We shall give points from the speeches next week; meanwhile we quote in detail an extraordinary intriguing announcement made by the Minister of Supply, Mr. Duncan Sandys, who was the guest of honour. He saved it until the end of his speech, when he referred to current vertical take-off experiments in America—where, as he said, aircraft were being cocked up on their tails and flown into the air like rockets.

"We in Britain," said Mr. Sandys, "are concentrating rather upon techniques designed to enable aircraft to take off vertically from a normal horizontal position.

"The necessary upward lift is provided by downward-facing jet streams whose direction can be varied to control the angle of climb. These could be provided either by small subsidiary engines, or, alternatively, by the deflection of the jet stream of the aircraft's main power units. These are, of course, no more than research projects. But good progress is being made.

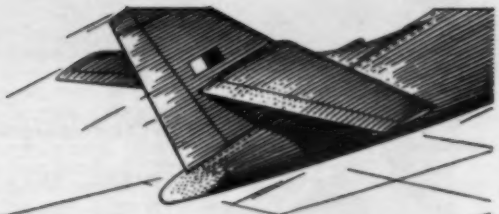
"In conjunction with the Ministry of Supply, Rolls-Royce have constructed a test vehicle embodying this principle. I can hardly call it an aircraft, for it is really no more than an aero-engine with a pilot mounted on top. A few weeks ago this strange contraption, which weighs 3½ tons, successfully lifted itself into the air without the aid of wings or rotors of any kind. It then proceeded to circle around under complete control for about ten minutes and landed again without trouble—a very remarkable performance.

"It may well be," continued Mr. Sandys, "that these new and exciting experiments will in due course lead to a revolution in aeronautical development every bit as important as that which has resulted from the introduction of the jet engine."


Guided weapons for defence by FAIREY
THE FAIREY AVIATION COMPANY LIMITED · HAYES · MIDDLESEX

THE SUPER SPRITE

a.t.o. rocket



It is estimated that in typical bomber installations Super Sprite assisted take-off rockets will yield up to 20% shortening of the take-off run or 10% increase in the take-off weight.

20% shorter take-off run
or
10% greater take-off weight

DE HAVILLAND ROCKET ENGINES

Years of intensive development in rocket engines for take-off and other applications.

DH ENGINES

THE DISPLAY PILOTS

NO aircraft—and, especially, no military aircraft—reaches general service without first being exhaustively tested and assessed by pilots trained in the art and science of flight testing. The names of many of these men seldom reach the headlines except in connection with some special event, such as a record attempt; and yet their work continues behind the scenes, so to speak, throughout the year. Although it has its moments both pleasant and unpleasant, test flying is an art requiring the highest degree of skill, combined with experience and wide technical knowledge—not of themselves spectacular—and the intention is always to reduce it as nearly as possible to an exact science. But the skill of the individual pilot is still the supreme factor, despite increasing use of scientific apparatus and recording devices and for this the test pilots are chosen by the manufacturers and the Services.

There are three phases in test flying—prototype testing, production testing and operational evaluation—and pilots engaged in all these phases are demonstrating the aircraft of their respective companies in the air at Farnborough this week. On this and the next two pages we reproduce photographs of them, so that spectators on the public days may be able to see and take a more personal interest in the man at the controls as each aircraft takes the air. In many cases, a number of pilots are sharing the demonstration work, and in these cases all are shown. Some last-minute changes must be expected. Spectators will be able to learn from the commentator's introduction the name of the particular pilot.

INDIVIDUAL DISPLAYS

Pilots shown here are giving individual demonstrations in the aircraft listed next to their photographs. These demonstrations will in fact make up the last part of the programme after the circuses referred to overleaf.

H. G. Hazelden
Victor

"Jim" Cooksey
Meteor N.F.14

David Masters
Gannet T.2

Tom Brooke-Smith
Sherpa

"Dick" Wheldon
Jet Provost

"Bea" Beamont
Canberra B.8

Peter Hillwood
Canberra B.8

"Wally" Runciman

"Jock" Eassie
Seamews

E. A. Tennant
Midge

"Roly" Falk

Jack Wales
Vulcan

J. G. Harrison
Vulcan

Gordon Slade

Peter Twiss
Fairey Delta

"Mike" Lithgow
Vickers 525

"Dave" Morgan

"Les" Colquhoun
Swift F.4a

Brian Trubshaw

"Jock" Bryce

Valiant B.2

Neville Duke

Hunter Variant

J. O. Lancaster

Hunter F.2

Peter Bois

Comet 2

John Cunningham

Comet 3

Peter Bugge

Comet 3

"Dickie" Rymer

Viscount

John Wilson

"Chris" Capper

D.H.110

"Dickie" Martin

"Geoff" Worrall

Javelins

S/L. P. Scott

F/L. I. B. Webster

Javelins (*seconded R.A.F. pilots*)

THE DISPLAY PILOTS . . .

The Bristol Britannia was due to appear only on Thursday, the day reserved for commercial aircraft, and was then to be flown by "Bill" Pegg. The fifth Javelin pilot will be F/L. P. W. R. Varley, recently seconded to Glosters, of whom no photograph is as yet available. As we closed for press Hawkers notified us of the inclusion of two more of their test pilots. T. D. Lucy and Hugh Merewether.

"Bill" Pegg

Britannia

Walter Gibb

Proteus-Ambassador

The flying programme begins with demonstrations by aircraft grouped in circuses approximately according to their type and function, and in this section, also, the pilots are arranged in the order of their appearance. Circus A consists of medium and light multi-engined aircraft, two of which are test-beds for new engines—the Ambassador with two Proteus 705s, and the Varsity with two Napier Elands; the first engine-type is a turboprop and the second a diesel-turbine compound.

CIRCUS A

J. F. Howman

Proteus-Ambassador

"Joe" F. Arnold

S. B. Oliver

Pembroke

Derek Taylor

G. H. Pike

Heron 2

"Mike" Randrup

H. K. Cartwright

Eland-Varsity

"Pat" Fillingham
Beaver 2

B. Radley
Provost

CIRCUS B

This consists of the lighter aircraft and should provide some excellent "small field" take-offs and landings, as well as Ranald Porteus' well-known spectacular Aiglet demonstration.

Ranald Porteus
A.O.P.9 and Aiglet

N. J. Capper
Pioneer 2

R. Morris
Gannet A.S.1

"Dickie" Mancus
Balliol

Almost entirely jet-propelled, this circus can be expected to provide all the sights and sounds of very high-speed runs, short take-offs and aerobatics

CIRCUS C

H. N. D. Bailey

"Jim" Heyworth
Meteor test-bed

"Johnnie" Squier
Canberra P.R.7

"Jock" Still
Canberra P.R.7

"Bill" Bedford

Frank Murphy
Hunter F.1

Frank Bullen

E. H. Statham

G. Auty
Olympus-Canberra

J. G. McCowan

E. G. Franklin
Seahawk F.B.3

"Bill" Else

Peter Aked

"Don" Griffith
Sapphire-Canberra

A. Wittridge

Peter Wilson

Peter Moore
Sycamore 4

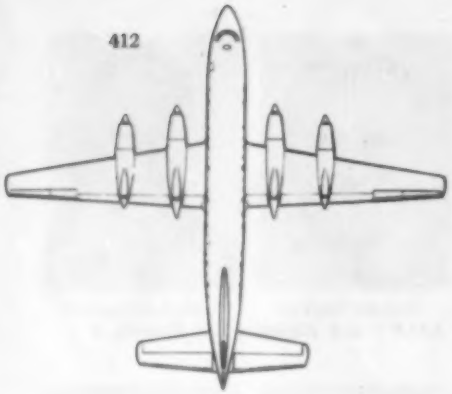
British-designed helicopters now flying number three and their particular brand of demonstration should prove a pleasant sequel to the mounting speeds of the preceding circuses.

CIRCUS D

"Sox" Hosegood
Bristol 173

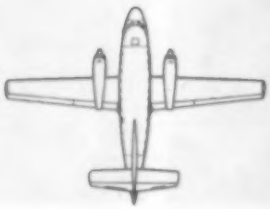
J. J. M. Jeffery
Skeeter 5

"Ken" Reed
Skeeter 6



TRANSPORTS IN PROSPECT

Practical Design Features



THE sharply contrasting transport aircraft described and depicted on these pages—the Bristol Britannia, Handley Page Herald, Aviation Traders Accountant and Scottish Aviation Prestwick Twin Pioneer—have at least three things in common. Above all, they are absolutely British. Next, they are quite unique (unless, that is, the Fokker/Fairchild Friendship is considered as a counterpart of the Accountant); and thirdly, they are all "fan-driven"—two by turboprops and two by piston engines. The Britannia is, of course, already familiar, but a few new particulars of the Series 100 are given in addition to the set of interior sketches.

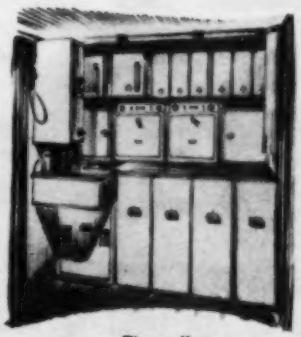
Bristol Britannia.—The earning power of every transport aircraft stems from a combination of speed, range and payload capacity. By existing standards, the Bristol Britannia promises to be exceptional on all three counts. These new interior views draw attention to the carrying ability of its long, unobstructed fuselage. The first 15 production Britannias, six of which are now in the final stages of assembly, will be Mk 100s, with a fuselage length of 114ft; later aircraft will embody a 10ft 3in "stretch," as illustrated by the Mk 300 plan-view on this page.

Even the initial Mk 100s, all of which are destined for service with B.O.A.C., will carry more passengers in first-class comfort than any of the Corporation's present aircraft. The minimum seating capacity is expected to be for 63 people; and the tourist version will accommodate 92. In both variants seats will be pitched at about 40 inches, allowing generous leg-room and ensuring that each row of seats is situated between a pair of windows. This flexibility results from the use of eight seat-rails perforated at one-inch intervals, allowing four-, five- or six-abreast seating. The B.O.A.C. first-class version will feature four-abreast seating, and the tourist layout, six-abreast. The 92-seat layout does not represent the ultimate passenger capacity of the "100" since seat-pitch can be reduced to 36in for "coach" work.

As these figures indicate, the Britannia is an unusually capacious aircraft. The width of its fuselage is particularly significant, since six-abreast seating has not previously been practicable for the great majority of main-line transports. The mean interior width of the Britannia cabin is 11ft 5in, compared with 9ft 10in for the DC-7 and 10ft 5in for the Super Constellation.

The Britannia fuselage is of circular section throughout its length; floor height is about 18in below the maximum width, allowing a gangway headroom of some 80in. The maximum designed differential pressure is 8.3 lb sq/in, corresponding to a cabin altitude of 5,000ft at a cruising height of 32,500ft. Sea-level conditions can be maintained up to 20,000ft. Double-glazed Perspex windows of vertical-ellipse shape are employed, the inner panel normally bearing the full cabin pressure. The outer panel

Proteus power plant in the cargo hold.

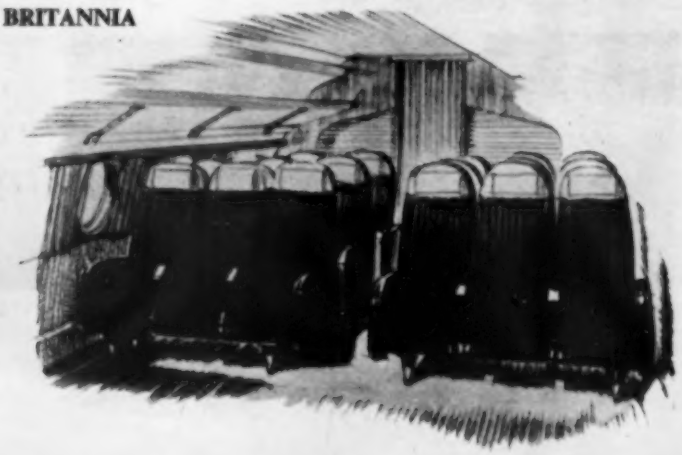


The galley.

Above, cocktail lounge; below, five-abreast seating.

Above, sleeping berths; below, six-abreast seating.

INSIDE THE BRITANNIA



PIONEER DESIGNERS OF THE EJECTION SEAT

News Flash

LOW EJECTION AT CHALGROVE

To determine a minimum altitude at which a safe ejection is practicable, with their latest Fully Automatic Ejection Seat, the Martin-Baker Aircraft Company conducted air tests at Chalgrove Airfield, Oxfordshire, on August 29th, 1954.

During the tests an ejection was made from a Meteor aircraft flying at 512 m.p.h. at the remarkably low height of fifty feet. The ejection was completely successful, the main parachute being fully deployed before the dummy alighted without injury.

This astonishing feat was made possible by the employment of two stabilising drogues in tandem, designed to reduce, with acceptable deceleration, the speed of the seat after ejection and then to control the main deployment of the parachute, thus eliminating the explosive opening characteristic. This seat was also fitted with the Martin-Baker Patent Barometrically Controlled Time Release Mechanism and Drogue Gun.

With this arrangement automatic separation from the seat after ejection occurs with insignificant loss of height, and safe escapes near the ground are made practicable. No other ejection seat is capable of this performance.

© These design features are patented in the principal countries of the world.

MARTIN-BAKER

AIRCRAFT COMPANY LIMITED HIGHER DENHAM NEAR UXBRIDGE MIDDLESEX

The flying-boat

RESURGENT TRANSPORT AIRCRAFT

WHILST *the post-war recession of the flying-boat was naturally a great disappointment to those who devoted their lives to the design, construction, flying and operation of this type of aircraft, it in no way dismayed them. They were certain that the flying-boat would return as an important factor in air transport.*

Even the delay in giving the great Saunders-Roe Princesses *an opportunity to demonstrate the commercial merits of the large modern flying-boat was to them no more than an unfortunate setback. Now they can see that their faith is to be justified.*

How it happened

The reasons for the flying-boat's temporary setback in air transport are easy to understand. First, as a result of the war, the runway aerodromes, built under wartime financial conditions, were ready for use in most parts of the world — and few realised that the prohibitive cost of *new* runway construction would soon begin to restrict the size (and efficiency) of landplanes.

LATEST OF THE LINE

The 140-ton Saunders-Roe Princess, *heralding the flying-boat's come-back in world air transport.*

Secondly, it was erroneously believed that large flying-boats could only operate from costly artificial bases — instead of natural stretches of water such as the Solent.

Then there was the idea that base facilities would involve heavy capital outlay — when in fact their cost is insignificant compared with landplane bases.

How wrong it would have been if, through these fallacious ideas, the flying-boat had remained unexploited — when it can lead to safer, faster, more economical passenger travel and military transport on the world's long-stage routes.

Princess the pointer

Marking the beginning of the resurgence of the flying-boat are the Saunders-Roe *Princesses* — each capable of carrying 130 passengers luxury-class or 220 tourist-class direct to New York. On long-range trooping operations, these three flying-boats could transport as many men as nine troopships.

And of course water-based aircraft like these can take full advantage of all the modern navigational aids and safety measures. Up-to-date docking and pontoon equipment has simplified maintenance and reduced dependence on surface craft. The large long-range flying-boat can now offer the fastest overall speed for long haul services.

The deciding issue

But what is decisive in bringing the flying-boat back into world air transport, both civil and military, is its flexibility — the fact that it can operate without pre-arranged facilities and accept re-routing at short notice. Think of the importance of this when political and military disturbances are liable to occur in almost any part of the world.

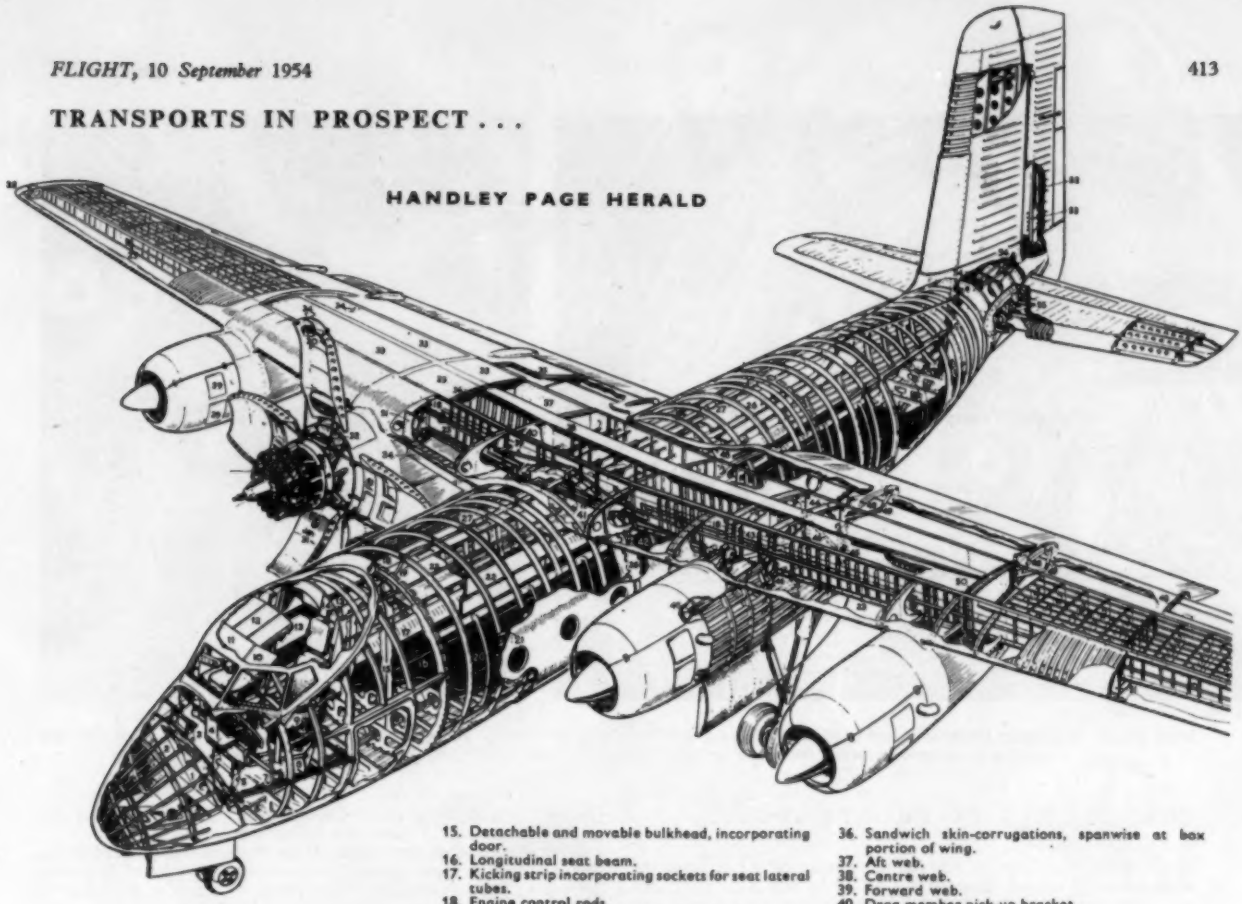
With sufficient flying-boats — modern, and large enough to offer low cost per ton-mile for all long-range operations — the prudent transport operator and military commander will be able to maintain communications over improvised or even entirely new routes.

That the flying-boat will come into its own again, that this valuable and natural heritage of the British Commonwealth will not be cast aside, is vitally important to us all.

An announcement by **SAUNDERS-ROE**

TRANSPORTS IN PROSPECT . . .

HANDLEY PAGE HERALD



1. Interconnecting rod for dual rudder pedals.
2. Forward pressure bulkhead.
3. 2nd pilot's rudder pedals.
4. Centre console—engine and trim controls.
5. 1st pilot's rudder pedals.
6. Rudder control rod.
7. Cockpit heating pipe.
8. Elevator control rod.
9. Seat-raising control handle.
10. Roof side panel—generator switches, etc.
11. Roof panel—engine electrical controls.
12. Roof panel—radio controllers.
13. Radio shelves.
14. Aileron control rod—in inclined duct in cockpit aft bulkhead.
15. Detachable and movable bulkhead, incorporating door.
16. Longitudinal seat beam.
17. Kicking strip incorporating sockets for seat lateral tubes.
18. Engine control rods.
19. Cockpit heating and windscreen de-misting pipe.
20. Hot-air pipes to kicking strip.
21. Top-hat stringers—brims welded to skin.
22. Cabin ceiling panel—lowered for access to controls.
23. Aileron control rod.
24. Hinged access panel under leading edge.
25. Forward main frame.
26. Thermal de-icing pipe for tail unit.
27. Re-circulating venturis—cabin ventilation.
28. Navigation lights.
29. Electrically actuated gills.
30. Cooling duct for oil cooler.
31. Air intake in lower petal.
32. Oil cooler.
33. Fuel tank access panels.
34. Fuel filler caps.
35. Sandwich skin-corrugations, chordwise at trailing edge.
36. Sandwich skin-corrugations, spanwise at box portion of wing.
37. Aft web.
38. Centre web.
39. Forward web.
40. Drag member pick-up bracket.
41. Control locking control cable.
42. Centre section forward attachment joint.
43. Nacelle and undercarriage forward pick-up brackets.
44. Undercarriage ribs.
45. Nacelle and undercarriage aft pick-up brackets.
46. Undercarriage pick-up bracket bracing tubes.
47. Engine mounting to bulkhead joint at nacelle top longeron.
48. Flap guides.
49. Flap operating rods.
50. Outer plane to centre-section joint.
51. Diaphragm at 10 per cent chord.
52. Trim-tab operating rod.
53. Rudder post.
54. Fin to frame attachment points.
55. Tailplane web to frame attachment points.

is strong enough to contain cabin pressure subject to a controlled leak through a vent, thus offering emergency protection against explosive decompression.

Handley Page Herald.—The drafting of the Herald specification and the laying down of the two prototypes now under construction was preceded by a world-wide survey of nearly every airline in Europe, Africa, Australasia and South America. In the course of this survey Handley Page representatives flew over the routes of many different airlines and talked with executives, pilots, engineers and passengers, enabling "a thousand and one small points, often neglected when the specification of a new aircraft is drawn up," to be considered at the initial design stage.

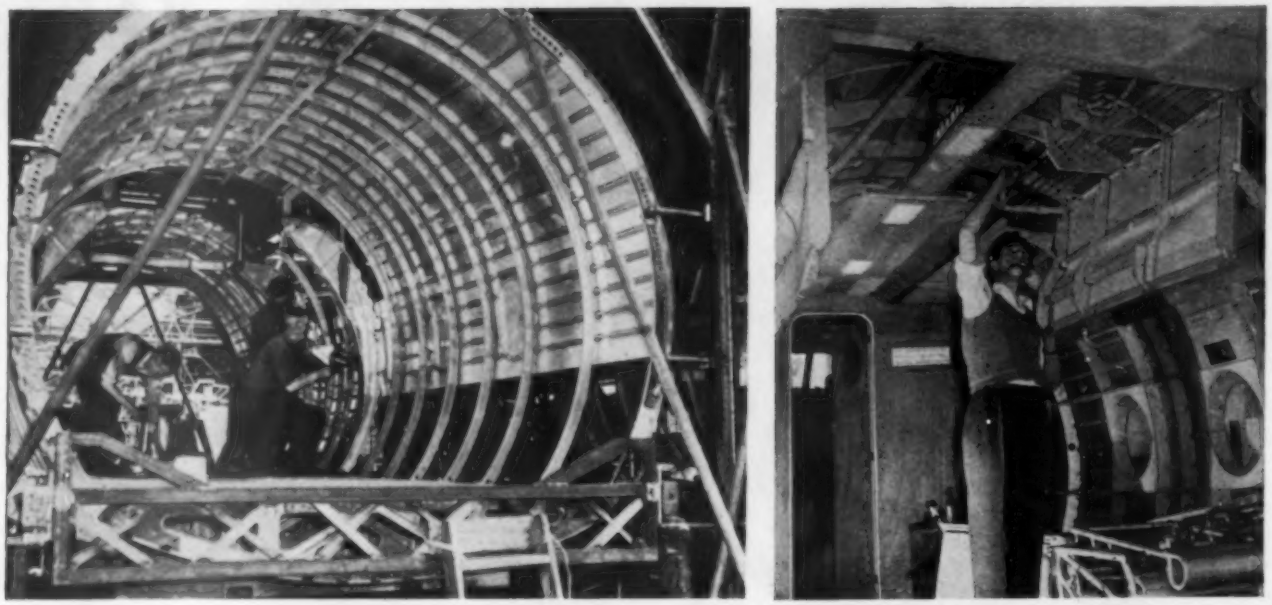
Operating costs over typical stages are quoted as 1.45 pence per passenger mile, or 15.2 pence per ton mile. As an airliner, the Herald is to carry 36 first class or 44 tourist class passengers, and by means of rapidly detachable or foldaway seats, layouts can be varied to suit traffic density. In the mixed rôle, passenger and freight compartments are separated by a movable partition; other removable partitions at the rear of the cabin form a toilet compartment. Special attention has been paid to the need for fast turn-round, and to that end the two doors, on the port side, are large and very close to ground level.

Forward of the fireproof bulkheads the Alvis Leonides Major power plants are interchangeable, with the exception of accessories and exhausts, and to reduce cabin noise all exhausts emerge from the cowling on the side away from the fuselage. The three-blade, D.H. airscrews have c.s. governing, feathering, reversing and electric de-icing. Safety features include automatic course-pitching and a pitch-lock, which, should other safeguards fail, secures the blades at their operating angle.

The semi-monocoque stressed-skin fuselage has three bulkheads; one, behind the cockpit, is structural, and the others, in the front and rear of the fuselage, are pressure bulkheads. The wing is in five portions—centre section, two outer panels and two detachable tip portions. The centre section, which carries all four engines, is of sandwich construction, having double skinning separated by metal corrugations. This is said to allow wing bending loads to be carried by the skin and to reduce the number of ribs required. Fowler-type flaps extend from the fuselage to the inner end of each aileron.

Aviation Traders Accountant.—Since Aviation Traders first announced the Accountant at Farnborough last year they have incorporated certain changes in the design to derive full benefit from the increased power of the Rolls-Royce Dart RDa 6 turboprops. The following main changes have been made "to achieve the best possible configuration to meet airworthiness requirements over a wide range of altitudes and temperatures without prejudice to take-off weight, take-off and landing runs, and cruising speed": (a) wing area increased to 600 sq ft, with an aspect ratio of 10; (b) initial take-off and landing weight increased to 24,000 lb; (c) initial disposable load increased to 10,350 lb; (d) provision made for a considerably increased fuel capacity in the wings, outboard of the engines, to provide operators with the widest variation between payload and stage lengths; (e) estimated cost increased to £87,500 (less radio) to cover structural changes; (f) fin height increased to 24ft 3in from ground; (g) seating capacity increased to accommodate 36 passengers; (h) envisaged increase in take-off weight to 26,000 lb.

The makers have compared the direct operating costs with those of the DC-3, using basically the S.B.A.C. method and basing calculations on an annual utilization of 2,000 hours. Purchase price of the DC-3 was taken as £27,250. Assuming an over-



Work is seen in progress above on a section of the fuselage of the first prototype Herald. The roominess is obvious. On the right, in the very complete mock-up at Reading, the hinged panels, which give access to the control runs, are being demonstrated.

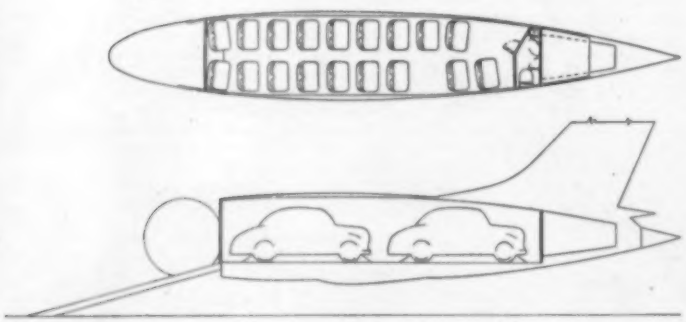
TRANSPORTS IN PROSPECT . . .

haul life for the Darts of 600 hr, the figures of the Accountant were found to exceed those of the DC-3 by less than 1.5 pence per long ton/nautical mile. With the increased overhaul life expected of the Dart by the time the Accountant is in production, together with the normal development of the aircraft, it is thought that the actual operating costs of the two types would in practice be almost identical. The Accountant, moreover, would have superior airfield performance, greater adaptability, increased disposable load and higher cruising speed.

Cabin length and height approximate to DC-3 measurements, but the width is increased to accommodate, as a normal provision, two rows of double seats in all passenger versions (other than V.I.P.) with adequate gangway width, providing for alternative arrangements, e.g., 26 seats with stewardess, buffet, stowage for coats, etc., 32 seats with stewardess and buffet, or 36 seats (high-density version) with stewardess. With a view to carrying both freight and passengers in varying radio on successive flights, provision is made for loading the freight at the forward end, and when it is required to load very large articles the whole of the crew's compartment can be hinged to give free access to the interior. A possible mixed load would be one 14 h.p. car and twelve passengers.

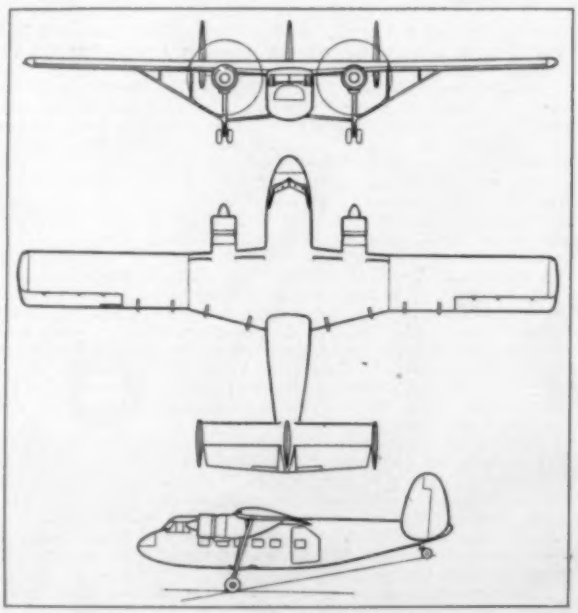
Cabin air is supplied by two Godfrey blowers, one driven by each Dart, and it is proposed to maintain a cabin altitude of 8,000ft up to a height of 30,000ft. Maximum cabin differential is therefore 6.5 lb/sq in. Cabin heating will be achieved by one of two methods—either by tapping the jet-pipe and passing air through heat exchangers, or by "choking" the supply from the blowers by means of adjustable restrictors.

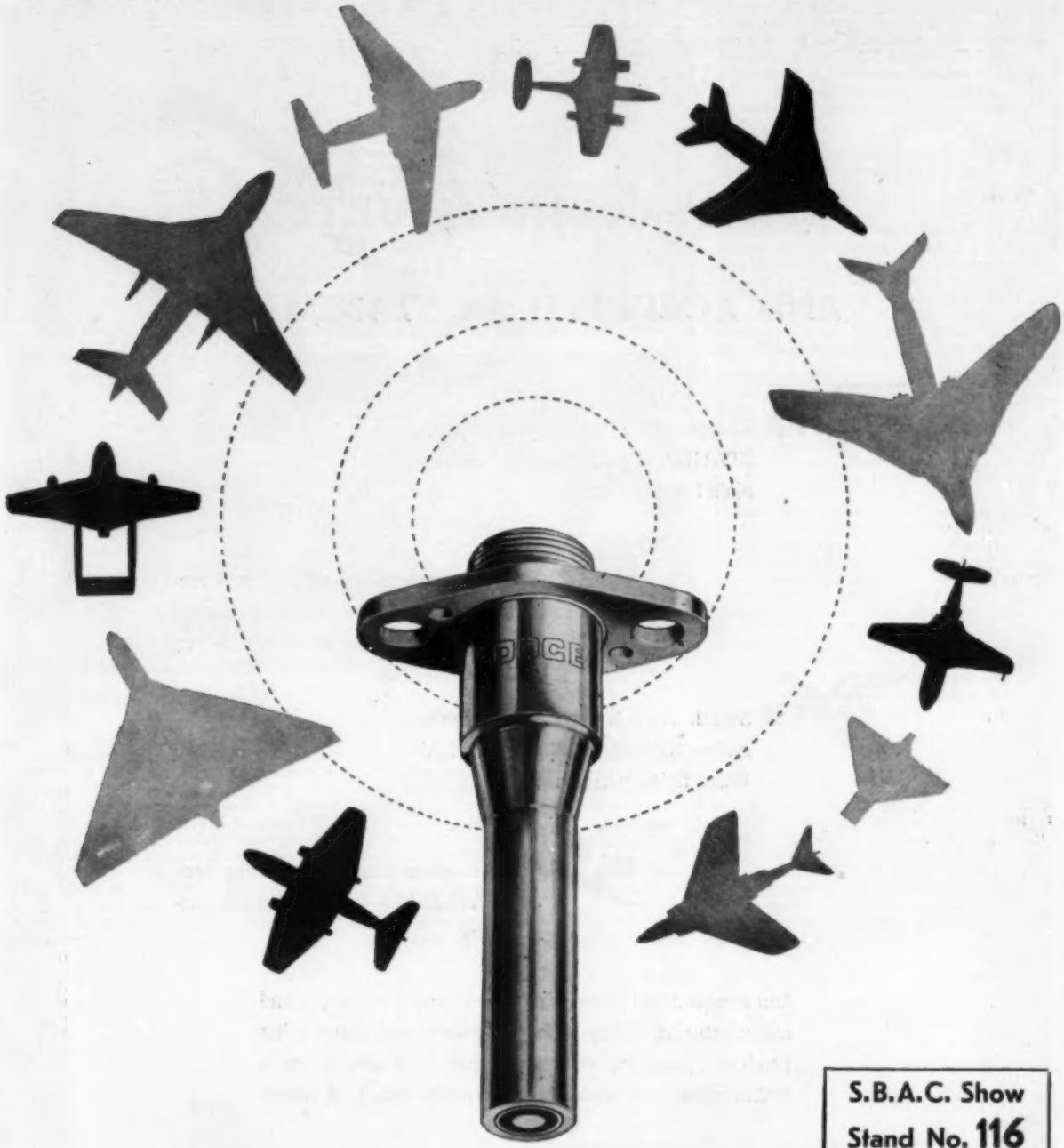
Showing, upper drawing a 36-seater layout of the Accountant and, below, the stowage of two 14 h.p. saloon cars. As a car ferry or heavy freighter the Accountant would have a hinged nose.



Scottish Aviation Prestwick Twin Pioneer.—Reproduced on this page is the latest general-arrangement drawing of this very promising Scottish venture. Compared with that in our issue of September 3rd, the new scheme will be seen to include a fuselage of broader cross-section, with parallel sides, revised windows and doors, modified undercarriage and redesigned vertical tail surfaces. As a passenger aircraft the Pioneer will carry a maximum of 16 people and baggage (14 and baggage if a toilet compartment is provided). Cruising speed at 5,000ft on 40 per cent of the take-off power of the two Alvis Leonides engines is quoted as 124 m.p.h., and the stalling speed (30 deg of flap, engines off) as 47.5 m.p.h. Maximum still-air range at 124 m.p.h. is 620 miles with a payload of about 3,000 lb. Take-off distance to 50ft on a concrete runway is 342 yd or on a grass runway 357 yd, and the initial rate of climb is 880ft/min.

General arrangement of the Prestwick Twin Pioneer (two Alvis Leonides).





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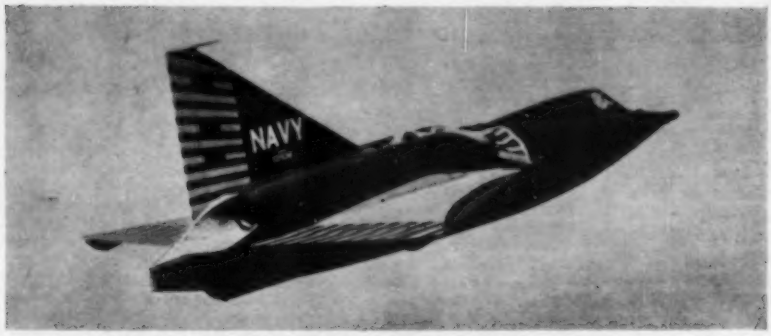


DELTA AND ROTOR: The Convair XF2Y-1 (top) has now achieved supersonic speed, and development continues, with a view to production of an advanced version comparable with the F-102; the Sikorsky XH-39 is a development of the S-52 powered by a Turboméca Artouste turboprop driving a four-blade rotor. It holds the world helicopter speed record at 156 m.p.h.

Great Britain

B.O.A.C. Transports. According to *Aviation Week*, "British Overseas Airways Corp. appears to be more interested in the Conway-powered Vickers 1000, commercial version of the Valiant bomber, than it is in the Comet 4, powered by the de Havilland Gyron, a high-speed turbojet engine." We republish this with the comment that the 1000 is as much a commercial version of the Valiant as the Boeing 707 is of the B-47. The 1000 is much bigger, much heavier, is low-wing, not high-wing, and has more sweep, to name only the more obvious differences.

U.S.A.

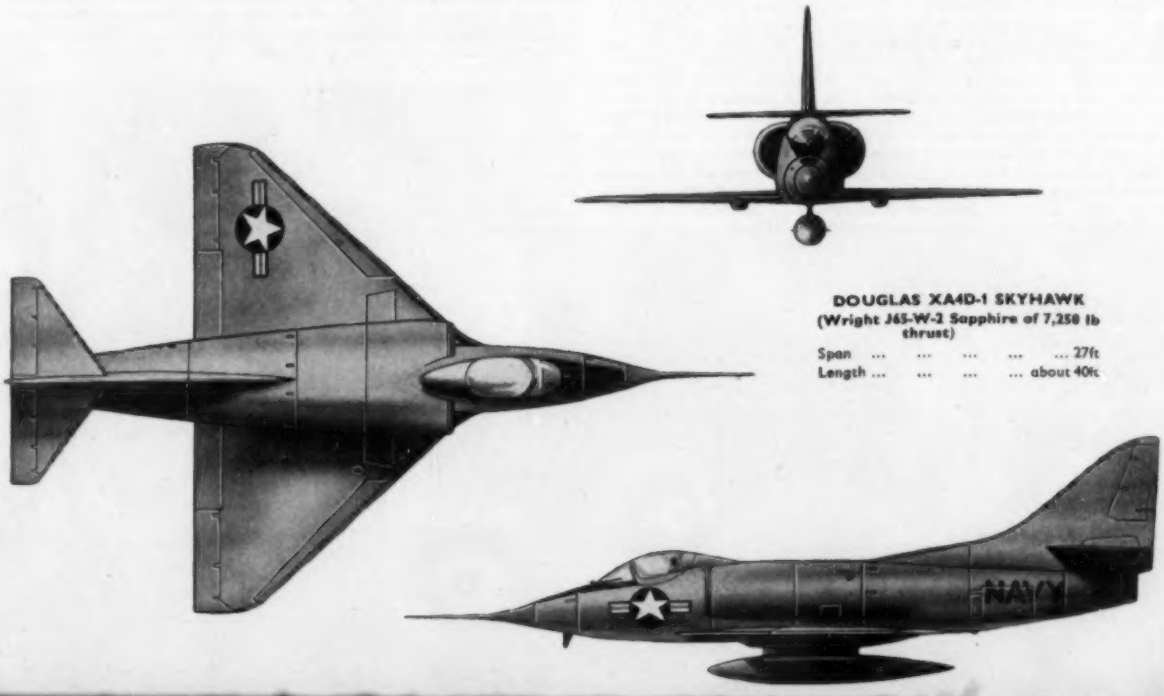
Cessna XT-37. This is a lightweight twin-jet basic trainer, which won a U.S.A.F. competition and is the subject of a service-test production order. The prototype has now been completed and flight trials are imminent. The selected power unit is the Continental J69 Marboré (Turboméca licence) which, in the J69-T-19 version, has been developed to give 1,000 lb thrust. The XT-37, however, has a pair of earlier Marborés rated at 880 lb, with the prospect of 925 lb available later at higher r.p.m. and jet-pipe temperature. The XT-37 has a layout identical with that of the Jet Provost, and also corresponds closely with the British aircraft in thrust and weight.

France

Dassault Mystère II with Special Tailpipe. A new type of tailpipe, including a variable area propelling nozzle "void of mechanical actuation," has been demonstrated on a SNECMA Atar 101 turbojet in a Dassault Mystère fighter. The new tailpipe is shortly to be put into series production for Atar 101-D.3s to be installed in Mystères.

Other Mystère Notes. On July 19th the prototype Mystère IV-N made its first flight, in the hands of Capt. Musselli. The IV-N is a radar-equipped all-weather fighter, seating pilot and navigator in tandem, and with a chin-intake and low-mounted all-flying tailplane. Supersonic speed was attained on the third flight in a shallow dive, and may now be possible on the level; the power unit of production aircraft will probably be a Hispano-built Avon with reheat, and armament includes a number of air-to-air missiles. On July 27th, Capt. Musselli took Serge Dassault, the manufacturer's son, for a supersonic ride in the IV-N. It is now learned that the type designation of the NATO light-attack aircraft is Mystère 26, and not Mystère 28. Other news is a reported order for six Mystère IIs for Israel and another order for 25 similar aircraft for Egypt.

S.N.C.A.S.O. 4050 Vautour. The third prototype Vautour has now left the factory and is about to begin flight testing at Melun-Villaroche. It is equipped as a bomber, and—unlike any previous French aircraft—is powered by a pair of Armstrong Siddeley Sapphires. Photographs have recently been released of a Vautour fuel system test rig, from which it can be seen that the fuel is housed in very large tanks occupying the whole upper half of the fuselage, supplemented by a single wing tank inboard of each engine nacelle.



DOUGLAS XA4D-1 SKYHAWK
(Wright J65-W-2 Sapphire of 7,250 lb thrust)

Span	27ft
Length	about 40ft

VERTICAL TAKE-OFF

A Review of Progress to Date: and a Consideration of Future Possibilities

By W. T. GUNSTON

ABOUT 99 per cent of all the aircraft ever built have derived their lift solely from the reaction of air flowing over a fixed wing. The odd one per cent comprise helicopters which hang from a power-driven rotor, autogiros and convertiplanes which combine the attributes of fixed- and rotating-wing machines, and two strange prototypes for the U.S. Navy which stand upright on their tails and screw themselves into the air.

Innumerable attempts have been made to combine the speed and efficiency of the fixed-wing machine with the independence of forward speed which is the chief attribute of the helicopter, but none has yet succeeded. If lift is to be independent of forward speed, it must be provided directly by engine power, and this has resulted in most of the helicopters which have been built in the past having disproportionately large engines and high operating costs. Furthermore, the aerodynamics of lifting rotors are such that they impose a definite limit to the forward speed attainable—a limit which varies with disc loading, and other factors, but is generally less than 170 m.p.h.

Even if helicopters as we know them today had come into general use early in the century, and had developed concurrently with fixed-wing aircraft, their applications would always have been restricted by the limitations mentioned above. Altogether, the fixed-wing machine has usually been more attractive for almost every purpose, although its fundamental characteristic of being wholly dependent upon forward speed is serious, even if taken for granted. At the present time, the world is covered, as never before, with aircraft of which a high proportion cannot fly comfortably at an air-speed below 70 m.p.h. at sea level (and, of course, a higher speed at higher altitudes) and many cannot fly at under 100 m.p.h.

Without wishing to labour a point which is obvious to any pilot, it is evident that, although the above is not of any great consequence when all goes well, it results in all modern combat aircraft, and most transports, becoming very unsuitable vehicles in adverse conditions. In spite of great technical advances, and the acceptance of added weight and complexity in the interest of increased safety, aircraft still get lost, ice up, run out of fuel or even—in some cases—cannot be flown at all if the powered-control system fails. If this is coupled with widespread bad weather, the inference is obvious—the crew must "hit the silk"; or, if the aircraft is carrying passengers, they must ride it down and trust to luck.

The present position can be summed up as follows: most of the work is done by fixed-wing aircraft which require large, well-maintained and fully equipped airfields, while for a limited range of applications the helicopter is the only possible vehicle, and has to be accepted in spite of its inherent deficiencies. There are signs, however, that great changes are taking place. It may be possible, within 10 years, to replace many of the more-important present-day types of aircraft with fundamentally better machines falling into three main categories. The first category is the convertiplane with a fixed wing and lifting rotor; the second is another convertiplane, which takes-off with the fuselage vertical, and otherwise resembles a fixed-wing machine; the third is the supersonic military aircraft which, by virtue of its great engine power, is enabled to accomplish many things including take-off from a very short run. The remainder of this account is devoted to a brief appraisal of each of these three types of aircraft.

The convertiplane as it is generally thought of today is in some respects the successor to the classic autogiro. Various types of convertiplane have been built, and very attractive machines are under active development, the most important being the Fairey Rotodyne. The principle of operation of these aircraft is that, for take-off, most (or all) of the power available is supplied to the lifting rotor(s) as in the conventional helicopter. Once well into the air, the power is gradually transferred to propulsive airscrews. In full forward flight, the aircraft behaves as a fixed-wing machine in many respects, and is supported by an autorotating (i.e., unpowered) rotor, and probably by a small fixed wing in addition, the latter being provided to increase stability and partially to unload the rotor and so increase cruising speed. The Rotodyne should, in fact, be able to land without using the rotor at all.

Such aircraft are likely to prove very attractive in many applications, particularly if the purchaser does not specify take-off from a standing start. In the author's opinion, direct vertical take-off is only rarely worth while, and the advantages which can be gained by permitting a ground run of even 100 yd are enormous. From the transport viewpoint, it makes all the difference between a profit-maker and an uneconomical proposition. Furthermore, a take-off site for a machine such as the Rotodyne would not necessarily have to be remote from a built-up area, for convertiplanes of this nature would climb out more steeply than could any fixed-wing transport, and hence would probably be at a height of several hundred feet before passing off the end of the strip in use. Noise at close quarters, however, might be another matter.

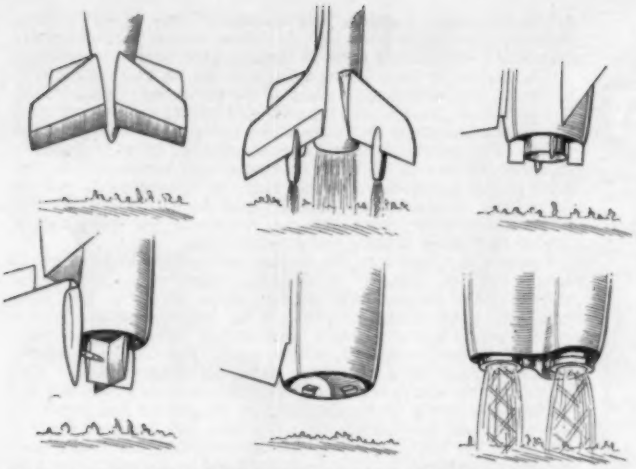
Convertiplanes can, with some confidence, be predicted as standard short-range transports for all kinds of load, and in such a rôle they stand a fair chance of supplanting fixed-wing machines entirely. Much has already been written about their commercial prospects, and so they will be left at this point—with an added note to the effect that there will always be plenty of specialized jobs for helicopters without any fixed wings.

The second type of convertiplane is essentially a true direct-lift v.t.o. machine, for in its normal take-off position it stands vertically upon its tail, and so cannot move laterally at all. The factor distinguishing all aircraft of this family is that both take-off and landing are made with the longitudinal axis of the aircraft vertical, i.e., at 90 deg to the position of normal cruising flight. In normal forward flight these aircraft behave like any other fixed-wing machine, in that the wing provides virtually all the lift and none of the forward thrust. At take-off the wing is largely superfluous, for it has no effect on the aircraft other than adding weight.

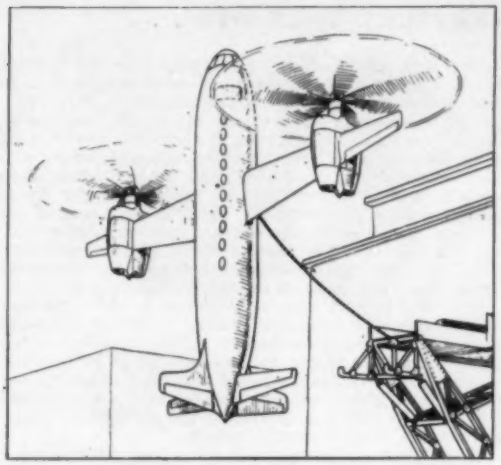
The basic requisite of such a machine is that, at take-off, the total thrust should be greater than the total weight—preferably in the ratio of at least 4 : 3. There are three basic solutions to this requirement: a shaft-drive engine may be employed to drive contra-rotating airscrews of large total blade area; a very large turbojet or other form of reaction engine may be employed; or additional rocket booster units may be fired during the take-off.

For a given rate of fuel consumption, airscrews provide the greatest thrust, and therefore a turboprop of good power/weight ratio is the easiest basis around which to design such an aircraft. The problems which have to be faced are also very much fewer if airscrew-type propulsion is adopted; conversely, such propulsion is likely to restrict the aircraft to rôles in which performance—certainly transonic performance—is not required. The military

The U.S. Navy's v.t.o. prototypes: the Convair XFY-1 (right) in free flight, and the Lockheed XFV-1 Salmon (below) standing on its auxiliary chassis, with the lifting cradle behind. Both are controlled solely by four tail surfaces.



Low-speed control systems: tail surfaces in airscrew-slipstream; rockets attached to tail controls; vanes on a by-pass jet; jettisonable controls on a turbojet; turbojet spoilers; and hinged rocket-motors.



A projected convertiplane by Bristol's Raoul Hafner; it embodies hinged seats for all passengers. It is pictured hovering at full power while being hauled in to a mooring structure.

v.t.o. machines of the future are certain to be jet-propelled, and many of them will have ample engine power for vertical take-off without penalizing any other aspect of their performance.

A less-obvious, but possibly more difficult, requirement is that the v.t.o. aircraft has to have a special type of control system. Nearly all present-day fixed-wing aircraft are controlled by providing movable surfaces (rudder, elevators and ailerons) upon which the slipstream can act, so that when the controls are moved the appropriate surfaces impose a force, or couple, which turns the aircraft about one or more axes. When the aircraft is at rest, the controls may be moved over their entire range of travel without causing any appreciable force on the aircraft; much will depend on the wind and on whether or not any of the surfaces are affected by the propulsive slipstream of the aircraft, but generally speaking the control systems of conventional aircraft are ineffective at forward speeds ranging between about 40 m.p.h. and 70 m.p.h. Somewhere within this speed range the controls of all fixed-wing aircraft take-effect in a manner which is obvious to the pilot, unless the control system is fully powered without feedback.

As a result, it is possible to ignore the low-speed uselessness of conventional controls, for the aircraft does not get into the air until its forward speed is sufficient for proper control response. The v.t.o. machine, however, has to be controllable in flight at practically zero forward speed. It is, in fact, the most difficult case, from the control point of view, currently met. The air-launched guided weapon always has sufficient airspeed for control and the ground-launched guided weapon is initially boosted by rockets so that the early phases of flight are more akin to the firing of a gun; within one or two seconds the speed is supersonic. Yet the manned aircraft cannot be launched with comparable acceleration; acceptable limits seem to be about 3g for fighters and less for other types.

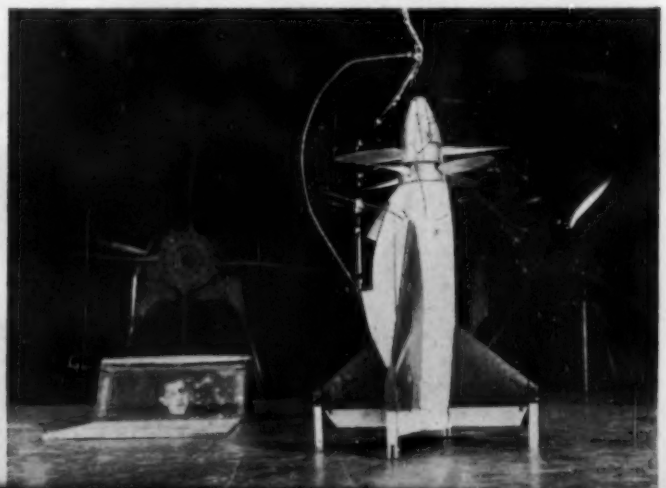
Again, various solutions present themselves. If the aircraft is propelled by airscrews, it may be possible to provide complete control by employing outsize tail surfaces placed within the slipstream, and this has been achieved with the two American turboprop prototypes. Alternatively, a large gyroscope may be used to maintain the longitudinal axis of the aircraft in a true vertical direction; any tendency towards toppling or other instability in pitch would thus be converted into relatively harmless rotation about the longitudinal axis in the form of an upward roll, and the gyro might be arranged to jettison once a suitable airspeed had been reached.

Another possibility is that small rockets could be attached to the normal control surfaces and fired before take-off; their reaction would be independent of airspeed and they could be dropped off when exhausted. An aircraft powered by a by-pass turbojet could have control surfaces mounted within the exit annulus of the by-pass air. It should not be impossible to develop a system of control vanes situated in the nozzle of a turbojet; ordinary mild-steel could be used and, owing to the high relative gas velocity, the surfaces could be quite small. The drawing shows jettisonable vanes, which would interfere with engine thrust only during take-off (unfortunately, this is when maximum thrust is required). Jet deflection could also be achieved by means of small spoilers, or compressed-air jets, mounted just inside the propelling nozzle—or even by having a complete hinged jet-pipe.

If the aircraft were rocket-propelled it is doubtful if any form of deviation of the jet would be possible, unless the whole combustion chamber were pivoted. The German A-4 (V-2) rocket was launched vertically, with an initial acceleration of only slightly more than 2g, and during its launching all control was provided by means of four graphite vanes mounted at 90-deg intervals around the chamber nozzle. These vanes rapidly became heated to incandescence, and had a design life of no more than two minutes. Such an arrangement would not be adequate for a manned, long-life, vehicle.

The idea of a pivoted rocket combustion chamber is not new, and several have been flown. Probably the best-known is the

Fairey's v.t.o. model (left) was a research aircraft with which the company learned a great deal about near-vertical launching at low accelerations. The model Convair XFY-1 (below) is shown under test in the full-scale tunnel of the N.A.C.A. Langley laboratory. The contra-rotating airscrews are driven by electric motors and the controller's head is visible behind the wire screen.



VERTICAL TAKE-OFF . . .

Fairey Beta motor which was employed on the Fairey V.T.O. Model with which extensive trials were completed in Australia some two or three years ago. As illustrated (p. 417), this research aircraft was launched with the aid of two 600 lb-thrust solid-fuel rocket boosters, supplementing the two 900 lb-thrust chambers of the main motor. These chambers were mounted one-above-the-other in the tail of the aircraft, and one was arranged to swivel laterally and the other vertically, probably under the influence of signals from an autopilot. The Woomera tests of models of this type, made under joint contract from the Ministry of Supply and the Australian Department of Supply, explored the practicability of launching aircraft from short ramps at low accelerations, and included test launches in near-vertical climbs.

If a fairly lengthy ramp is employed, to which the aircraft can be constrained by rails, it is possible to obviate the necessity for a low-speed control mechanism. This has been a feature of several pilotless weapons, such as the Fieseler Fi 103 (V-1) flying bomb, and it was also employed with the Bachem Ba 349 Natter manned intercepter, which was launched almost vertically. Both these aircraft managed to take to the air with no more than a conventional aircraft control system.

When given sufficient power and proper control it is possible to get an aircraft to rise vertically and climb away. Clearly, if the aircraft has an air-breathing engine, there will be some point at which the aircraft can no longer climb owing to the reduced air density causing a fall-off in power until the thrust is no longer greater than the weight. It is therefore necessary, even if the aircraft is an intercepter whose sole immediate object is to gain altitude, to cease "hanging on the prop" and bring the fixed wings into use.

At one time it was considered that this could most effectively be achieved by allowing the aircraft to enter a semi-controlled stall in the forward direction followed by a dive during which the wings would become unstalled. The aircraft could then pull-out and climb away using the lift from the wing. Extensive experiments have shown that this is an unnecessary procedure, and that the transition can be made directly, i.e., the angle of climb can be gradually reduced and the nose steadily lowered until the aircraft is established in a conventional fixed-wing climb, the wing gradually taking the load without ever becoming stalled.

In normal flight the v.t.o. machine will probably have few distinguishing features and conventional flight characteristics. It may be expected to be rather shorter and squatter than usual and, if a fighter, may be over-stable as a result of the large tail. If it is airscrew-propelled, contra-rotating airscrews will be employed, since single-rotation units would impose a torque reaction on the aircraft which could not readily be countered during the low-speed régime at take-off.

Getting the aircraft back on to the ground should be no great problem, if the take-off requirements have been met. The possible solutions are descent by parachute, landing on the tail at full power (the reverse of the take-off procedure) and conventional landing with forward speed on to an auxiliary undercarriage.

Descent by parachute is not attractive, owing to the fact that the aircraft is placed wholly at the mercy of the wind and no form of control appears practicable; this will be referred to later on. Landing with the fuselage vertical seems quite feasible, although some novel problems are posed thereby. For example, the pilot will have to look over his shoulder in a most uncomfortable manner, or else employ a system of mirrors, if he is to make the landing visually. Again, as the landing is carried out under power, no normal fixed-wing method of warning of flap or undercarriage position applies; on the other hand, this type of indication may not be necessary. Landing "conventionally" may be worth while, since with fuel exhausted and the flying weight proportionately reduced, a very simple form of landing gear might be sufficient.

The transition from forward flight to the landing régime will, of course, vary according to which of the three methods is adopted. If a parachute is employed, the pilot will merely close the throttle, kill the excess speed and stream the canopy at the appropriate point. The parachute would almost certainly be so arranged as to lower the aircraft with the horizontal axis horizontal—an un-Irish way of saying that it would alight in flying attitude and not on its tail. A conventional landing with forward speed calls for no comment, other than noting that the special low-speed control system may make landing exceptionally easy.

Powered landings with the fuselage vertical can be achieved by simply "flying through" a transition zone, as follows: close throttle—lose height—join circuit—allow speed to fall off—gradually open throttle while pulling back on stick—balance engine power against attitude until aircraft is hanging vertically at zero airspeed—slightly reduce power and descend—finally, increase thrust before touching down to effect hold-off. This sounds rather tricky, and interference between the slipstream and tail controls owing to the proximity of the ground may make the actual landing doubly difficult. We have watched ciné films of the American XFY-1 carrying out the procedure and, while quite successful, the operation seems delicate and to demand rather a lot of a normal pilot.

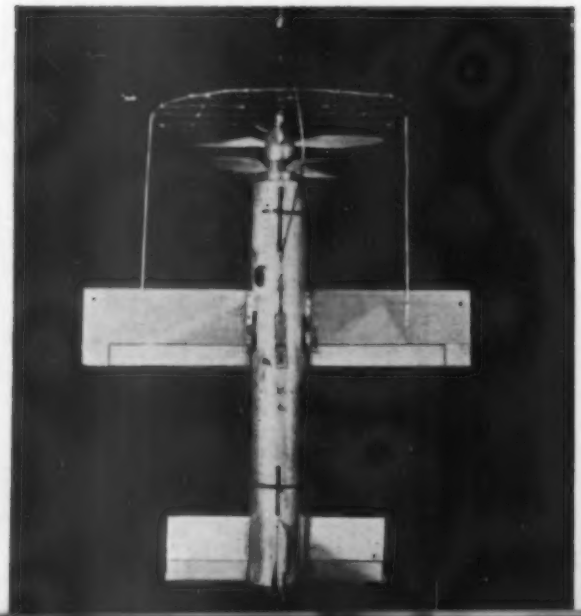
Many readers will already have thought of the possibility of engine failure. This does, in fact, seem to be one of several niggers in the wood-pile as far as v.t.o. machines are concerned. The helicopter, although equally dependent upon its engine, is provided with a rotor with a high moment of inertia, so that autorotative landings are possible by using up the stored kinetic energy. This is denied the v.t.o. machine, which—as far as published information is concerned—has no alternative but to use a parachute.

Both the Convair and Lockheed fighters have large hollow airscrew spinners projecting forward of the actual hub mechanism, used as a housing for a large parachute of novel form. The Lockheed system was patented in 1951, when the company began v.t.o. work, the inventor being Eugene C. Frost. The effect of complete, or even partial, power failure during the take-off or landing régimes would result in the aircraft starting to sink, tail-first. Nevertheless, the local airflow through the airscrews would continue to be in a downward direction as long as the blades continued to rotate in an unstalled condition. This made it essential to eject the parachute forcibly upwards so that it can reach an upward-moving airflow before opening. The chute is fired through the jettisonable spinner-cap by an explosive charge. Weights attached to the canopy assist in carrying it clear of the flow through the airscrews, and resilient metal strips arranged around the hem of the canopy cause the parachute to spring partially open as soon as it has left the confines of the spinner.

Parachute landings are seen only as an emergency procedure, for the sinking speed, while low enough to allow the crew to escape unharmed, would probably still be sufficiently high to cause more than local damage to the aircraft.

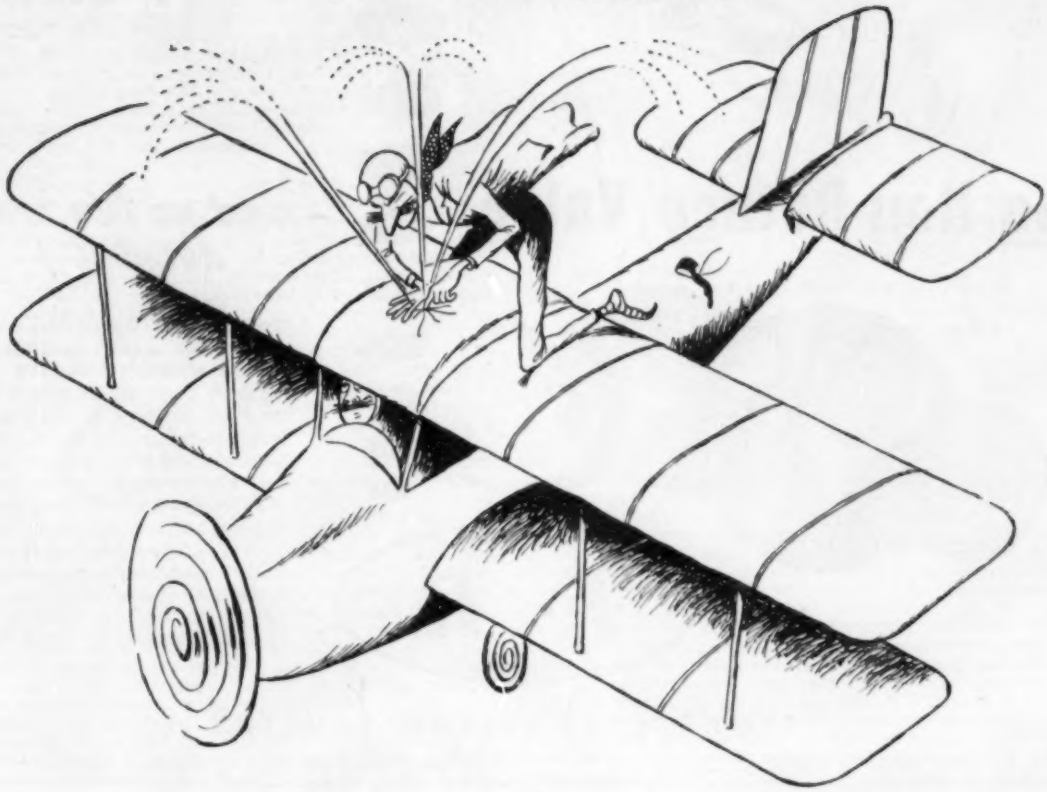
Engine failure in full flight should be less of a problem. There is, however, a difficulty in accomplishing a normal glide landing, introduced by the necessity of having a large, essentially cruciform, tail. Both the Convair and Lockheed fighters would, if brought in to land conventionally, touch down upon a six-blade airscrew at one end and a massive tail unit at the other, and serious damage would be the inevitable result. It is worth noting that the ventral fin of the Convair machine is arranged to jettison, in order to make normal belly landings more practicable.

As the photographs show, both these U.S. Navy prototypes have four castoring wheels on shock-absorbing, long-stroke legs attached to the extremities of the tail surfaces. Although these legs do not have to do more than accept landing shocks, which should be almost entirely vertical, the wheelbase or track has to be as large as possible, in order to achieve an acceptable measure of ground stability. Vertical take-off aircraft may have to operate from a ship, which might be rolling in a rough sea; they may also have to stand on the ground in high winds. Not only is the widest



The first vertically-rising model flown by the N.A.C.A. was the five horsepower, straight-winged machine seen on the left. Unlike the Lockheed Salmon, it has ailerons on the wings. The flying barrel (below) has a ducted contra-rotating fan, and was used in hovering experiments.

The not-so-serious...



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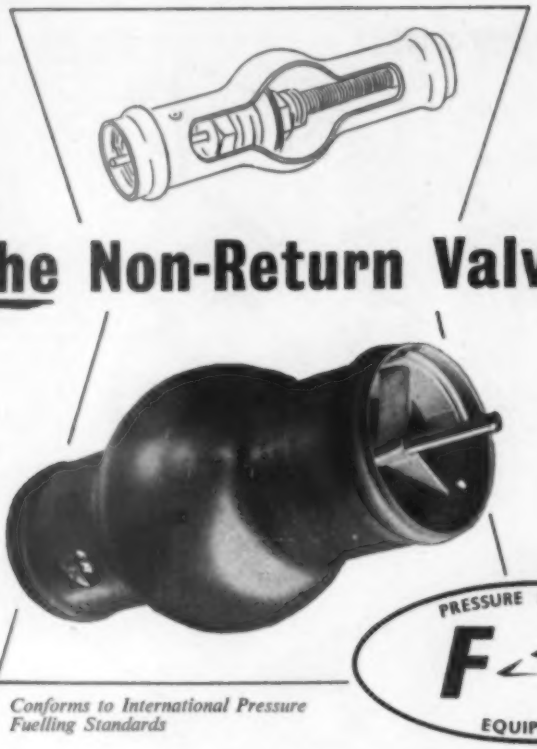

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VERTICAL TAKE-OFF . . .

possible undercarriage spread required, but the overall length (or, in the take-off position, height) has to be kept to a minimum.

A unique feature of the Lockheed XFV-1 Salmon is the provision made for flying as a conventional fixed-wing aircraft, using an auxiliary landing gear with two main wheels and two small tail wheels. This permitted extensive test-flying in advance of attempts at vertical take-offs. The Convair XFY-1 was unable to operate from a normal undercarriage, largely owing to the large fin at "six o'clock"; in this case, initial "flight" (or, more accurately, "perpendicular taxying") trials were undertaken in an airship hangar, with the aircraft partially tethered by cables.

There are, of course, a host of equipment—and accessory—problems involved in designing an efficient v.t.o. machine. In the two American aircraft, special fuel and oil systems had to be provided, together with special instrumentation (non-toppling artificial horizons, for example). Another feature is the manner in which the ejector seat is arranged to tilt forwards when the aircraft is pointed vertically upwards; this makes things much more comfortable for the pilot, who would otherwise tend to slide out head-first through the canopy, the latter being open during take-off and landing. Foot stirrups are another requirement. Pilots will also be inclined to muse on the shortcomings of aircraft in which personal gear, map-bags, and so forth, have to be strapped down to a vertical floor.

A definite drawback to all tail-standing v.t.o. aircraft is that they require extensive ground-servicing equipment. The largest items of this nature are hinged cradles which not only act as vehicles upon which the aircraft can be moved from place to place on the ground but also incorporate hydraulic rams which raise the aircraft into a vertical position for take-off. The same sort of equipment was first used on the German A-4 rocket. Between-flight servicing and refuelling can, of course, be carried out with the aircraft standing on its tail, but anything like complete overhaul necessitates re-positioning nearer to the ground with the major axis of the aircraft horizontal. Access to the cockpit of the American prototypes is gained *via* a 20ft ladder, and some sort of escape arrangement for the pilot—probably a knotted rope—is an essential emergency provision.

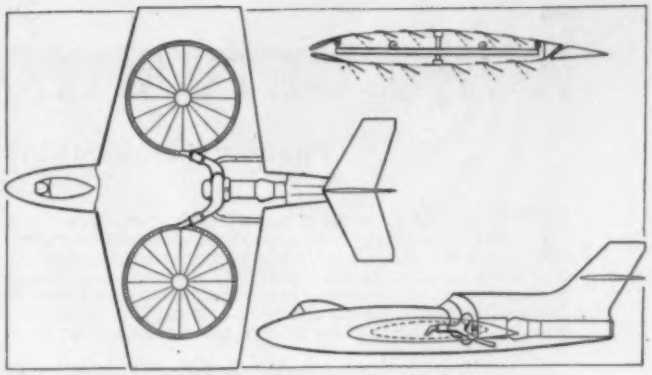
Jet-propelled aircraft of this type may also require special take-off and landing platforms immune to jet blast. It may also be necessary, with future v.t.o. machines, to equip them for in-flight refuelling, so that they can take off with tanks only partially full. For example, a supersonic all-weather fighter might weigh 25,000 lb during a vertical take-off under the thrust of two 15,000-lb-thrust turbojets assisted by a 10,000-lb-thrust rocket; once in forward flight, supported by the wing, as much as 15,000 lb of additional fuel might be put aboard before the aircraft left for its mission. This sort of procedure would not be acceptable for intercepters, which have to start climbing to combat height as soon as they become airborne.

There are several other methods by which the take-off run of a fixed-wing machine may be reduced, or eliminated. One such method is to employ an additional wing, of large area and good low-speed properties, which can be jettisoned at, say, about 300 m.p.h. Slip-wings have already been examined both on fixed-wing aircraft and missiles, and their use may be worth while for long-distance bombers with high initial wing loadings.

Alternatively, supersonic aircraft may be so designed as to utilize their great thrust in a downward direction at take-off. There is no reason why engine thrust should always be directed to the rear and, if deviation can be accomplished without loss of power, the following might be a practicable method of becoming airborne where thrust is greater than the weight. The take-off run could be started normally up to a speed of some 70 knots—reached very rapidly, owing to the great excess of thrust over drag and inertia. The thrust of all power units—say, four large turbojets each with an underslung booster rocket—would then be directed substantially downwards (as a patent specification might put it) leaving a small horizontal component to prevent any reduction in forward speed. The nose of the aircraft would then be lifted and the aircraft flown off, most of the lift coming from the power units.

The thrust-lines of the engines would then be progressively returned to normal, the increasing airspeed permitting the wing to accept a progressively greater share of the total load. The rocket boosters would then be jettisoned and the aircraft flown out normally. An installation might have four podded turbojets, the pods being hinged and tilted by hydraulic jacks. Ideally, the aircraft should be taken off at almost stalling angle-of-attack of the main wing, and the engine thrust angle might be automatically linked with angle of attack so that, if forward speed began to fall (with a resulting rise in angle of attack) the thrust lines could be directed rather more to the rear. Admittedly such a scheme would require careful consideration and model-testing, but where ample thrust is available it should cut down the runway requirements of fast bombers by as much as 90 per cent.

The French Bréguet company have a number of strange projects



This remarkable Bréguet project is referred to below.

in the offing, among them the convertiplane illustrated by our sketch on this page. It appears at first glance to be the type of brain-child of the numerous "mad inventors" to whom so many patents of this type of machine are granted. Nevertheless it is the product of a great and experienced company, and is not to be passed over as impracticable. The aircraft has the following layout: a conventionally mounted turbojet is arranged to drive an auxiliary air-compressor, which supplies jets within the wing roots impinging upon the blades of enormous turbines lying within the wing and turning about vertical axes. The region between these blades and their hubs is occupied by radial vanes so that the complete assembly behaves somewhat as a helicopter rotor—or, more accurately, as an airscrew lying on its side. The wing skin above and below each rotor is formed from hinged flaps to admit air above and pass it out beneath. The resultant reaction provides lift at zero forward speed. In normal flight, the rotors are stopped and all power is supplied to the propulsive jet, the wing skins then being closed to provide lift in fixed-wing manner.

Another line of development aimed at obtaining short take-off runs without mechanical complexity is the investigation of the properties of multiple aerofoils, arranged in a cascade one above the other—a typical figure being ten superimposed wings. The N.A.C.A., who probably know more about vertical take-off than any other single research organization, conducted extensive experiments with multi-wing models during the past five years, and some remarkable figures have been recorded. Nevertheless, an aircraft with this layout could clearly have only limited applications—such as artillery-spotting and anti-submarine warfare. Stacks of aerofoils are particularly good slow-speed lifters if they are mounted behind large, slow-speed airscrews. This recalls the Airspeed and General Aircraft fleet shadower aircraft built during 1941; these aircraft, although they employed but one wing, had almost full-span slipstream (from four small Pobjoy radials) and, with further assistance from high-lift devices, were thereby enabled to cruise at some 35 m.p.h. under full control.

One of the most remarkable v.t.o. aircraft ever projected, and a design which fell into no accepted aircraft classification, was the Focke-Wulf rotating-wing fighter of 1944 conception (no type number was allocated). This design was for a tail-standing aircraft in which, in place of the normal wings, three rotating radial "wings" were mounted at 120-deg intervals round the fuselage, rather as if a huge airscrew were mounted where the wing ought to be. Each wing was of variable pitch, and was driven by a Lorin duct (open-mouthed ramjet) at the tip.

At take-off the wings were accelerated by auxiliary rockets to a tip speed of 670ft/sec (455 m.p.h.), and the ramjets fired. Initially in zero pitch, the wings were then to be moved to fine positive pitch to lift the aircraft off the ground. At a suitable height the aircraft was to be levelled out, and pitch increased to increase the forward speed. At full speed of 620 m.p.h. the wing tip-speed was to be Mach 0.9 and the rotational speed 220 r.p.m. This design was to weigh 11,400 lb all-up, and the work was far advanced when the war ended.

There remain three other v.t.o. projects which can be mentioned at the present time. For the U.S.A.F., jet-propelled v.t.o. protoypes are under construction (almost ready to fly, in fact) at the factories of Bell and Ryan. Initially, both are expected to require rocket boost for take-off, although they are expected to provide data with which supersonic fighters for the 1960 era can be planned.

The third project is very properly still shrouded in secrecy; it is Avro Canada's "Project Y," now under development at Malton. A year ago, Sir Frank Spriggs described it to us as "a circular delta"; and it may be as well to leave it at that.

In conclusion, it should be understood that, although nearly all the work here described is not British, it should not be inferred that our designers are not fully alive to the possibilities of the subject. We may, perhaps, be missing out the unproductive airscrew stage to concentrate on jet aircraft of very advanced forms.

AGRICULTURAL CONTROL BY AIR

Practical Considerations from a Pilot's Viewpoint

A GREAT deal has been written at second hand about crop dusting and other agricultural flying, but it is seldom that a pilot who has had considerable experience of the work can be induced to write down his views. These notes are from Richard Bradbury, an Englishman who served in the R.A.F. during the war and who has in the last year or two dusted and sprayed in America. The information is concerned with only a few aspects of a specialized work which differs the world over according to climate, crop, terrain and aircraft available. These first-hand observations are particularly valuable by reason of their practical nature.

THE specific problems connected with crop dusting and spraying by aircraft have always been considered very complex, and contrary to popular belief the control of crop growth is by no means a standardized procedure. Since the need for destroying pests injurious to crop health is apparent with almost all kinds of agriculture for the commercial market it is readily seen that there can be no machine which is the cure-all and the do-all for this particular application.

Before the advent of the aeroplane, and indeed prior to the use of mechanical equipment for administering insecticides, few farmers would risk putting all their eggs in one basket and producing one form of crop only; the likelihood of losing their entire holding was too considerable. Various forms of mechanically driven ground dusters and sprayers have appreciably reduced this danger and have proved a relatively inexpensive and efficient means of control.

There are, however, two significant drawbacks to ground-control of most crops—crop damage and time. To a certain extent these two problems go hand-in-hand, as it is the necessity for the continuation of dusting at regular time intervals after the plant has grown up that results in the most damage to crops.

By RICHARD BRADBURY

The principle of protection with fungicide can be considered analogous to life insurance—the fungicide must be on the leaf before the fungus arrives; protection cannot be obtained when once the plant has started to die. For this reason complete coverage of all surfaces is an absolute "must", and at definite time intervals. With the many different types of fruits and vegetables each requiring careful consideration of type of chemical, rate of applications, etc., ground dusting is entirely inadequate and the use of aircraft is a necessity.

From the farmer's standpoint crop control by air leaves little to be desired apart from two exceptions—total coverage and proper timing. Total coverage means getting into all the corners; and with many premium crops (tobacco and soya beans, for example) grown in hilly chopped-up terrain, reaching into the corners by aeroplane is virtually impossible. It is of no use protecting the whole centre of an area if, after the first rainfall, it is cleared of fungicide and ready to be devoured by the unharmed invader from the safety of its corner.

Proper timing requires that the fungicide be administered to the crop at a specific period, notwithstanding the hour of day or night or the prevailing meteorological conditions. Night is a favourable time for spraying, because more uniform temperatures, and the absence of daylight thermals, make it simpler to control the dust or spray. With certain crops night dusting is imperative. Thus the ability to maintain a 24-hour control is of extreme value since it enables the better timing of the applications as demanded by weather conditions.

From the farmer's standpoint then, so be it. From the pilot's point of view, however, the demands arising in various areas of operation are by no means easily complied with. A few of his main problems are: danger, greatly increased when flying in chopped up or obstructed terrain; inability to deliver complete coverage; severe strain caused by long hours on a "dust when you can" basis; field maintenance; inaccessibility of a landing field for refuelling; and, among many other problems, keeping within the law.

At a glance the crop dusting pilot needs a special aircraft and special laws. In most cases air law must be, and is, relaxed for agricultural airwork, but not always to the necessary extent. The aircraft offers two choices: fixed wing and rotary wing. No fixed wing aircraft, no matter how specially designed, can claim superiority over the helicopter in this particular field. At this stage of helicopter development, however, the aeroplane retains one over-riding asset—economy, the all-important consideration without which the farmer ceases to produce a profitable crop.

The basic configuration of an aeroplane suitable for crop-control may vary considerably, but the finished product must satisfy a rigid set of requirements. First, the aircraft must be small; large aeroplanes prove too unweildy for tight operations. Second, it must be manœuvrable at extremely slow speeds; no speed is too slow; high speeds are not important. Third, it must be robust and incorporate a good measure of safety for the pilot in the event of a crash landing. Along with these pre-requisites it should carry a useful load of 500/600 lb excluding fuel and oil, be simple to maintain and be as fire free as possible.

To be small and manœuvrable, yet have a low wing loading, the biplane would seem the first choice. The biplane also offers greater protection for the pilot in the form of a strong upper centre section under which he can be seated. Staggered, swept back wings increase visibility and permit the useful load to be carried just behind the pilot and close to the centre of gravity. Most crop dusting pilots prefer the load to be carried forward (as in the front cockpit of a Stearman) for although visibility is limited from the rear seat, in the event of a crash landing to be between the engine and the load is not at all desirable. This preference, however, stems from flying make-shift aircraft, e.g., the Piper Cub type of duster, where the huge tank is placed not too securely directly behind the pilot. A specially constructed aircraft would obviate the risk of the tank getting loose, and since visibility is of paramount importance the pilot should sit as far forward as possible.

Spoilers, slots or flaps need not be automatic or adjustable, as the speed range need only be small, but the aircraft should be clean.

The engine should have a large reserve of power, and for normal operations not more than 60 per cent should be needed. Some form of additional cooling is desirable for continuous slow flying, and for simplicity a fixed airscrew should be employed, with fine pitch.

For robustness and ease of maintenance a metal covered fuselage and fabric covered wings have been found preferable. Wings and tail unit frequently suffer damage throughout the dusting season and must be easy to repair. To distribute 500/600 lb of fungicide may take over an hour, and the duration of the aircraft must include the time to and from the refuelling point, which may add another 30 minutes each way.

The hopper is situated to best advantage well inside the slipstream, although when liquid spray is used pressurized nozzles may be extended quite far out under the wing. Tail surfaces, if fabric, should be kept well clear of the insecticide to prevent surface corrosion.

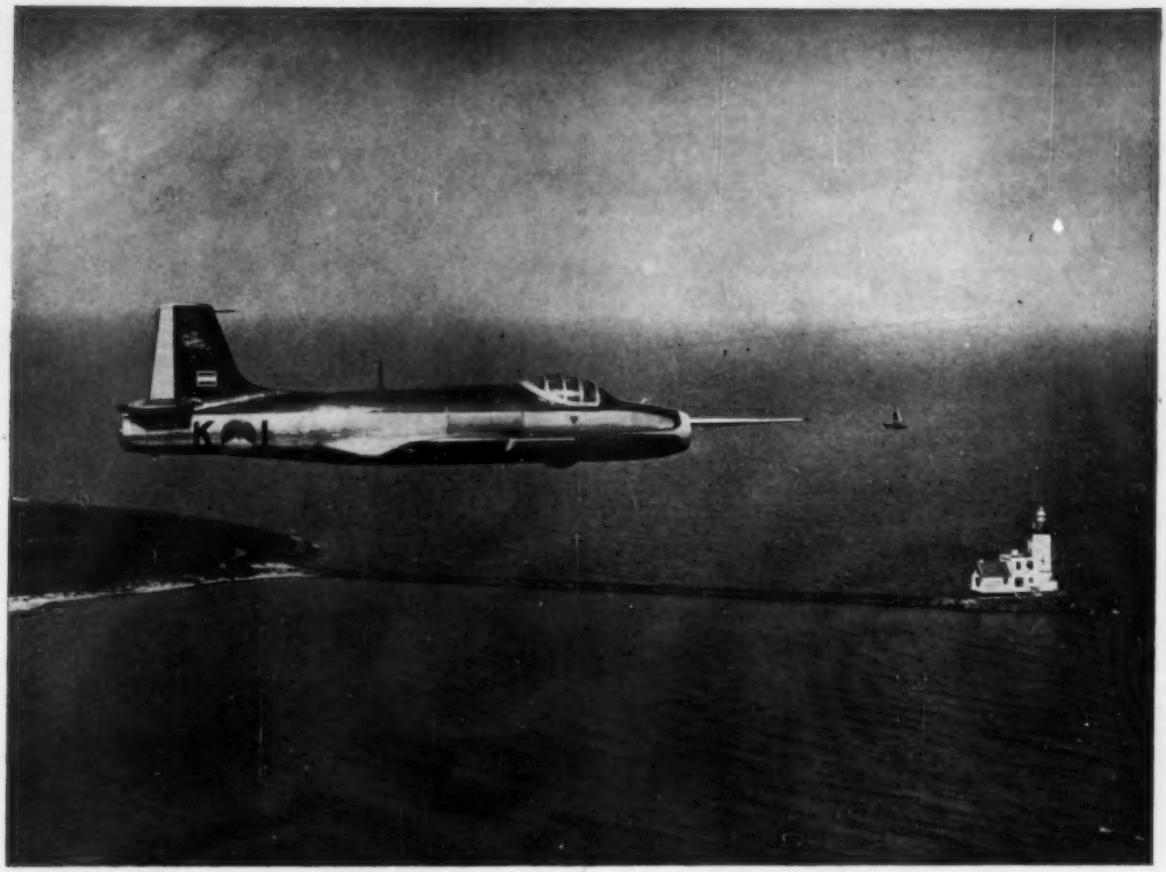
The aeroplane should be easy to fly. Too frequently, though not at all desirably, inexperienced pilots are encouraged to dust crops in order to build up their time. It cannot be over-emphasized that this form of flying calls for absolute skill and a thorough knowledge of timing, wind drift and accurate perception of distance.

No aeroplane at present in use was designed primarily for agricultural control. Although some constructors sell new aircraft specifically adapted for this purpose they are in fact "hand-me-downs," usually a modernized version of an old training or club type aircraft furnished with the latest type dusting or spraying equipment. These can do useful work, but no aircraft which relies on forward speed to remain airborne can provide the ultimate answer to the numerous and sometimes conflicting demands of agricultural control.

If the helicopter had been invented with the one purpose of increasing the well-being of man, then that purpose, apart from directly saving his life, would be saving his food. Strange as it may seem, not one helicopter has so far been designed solely for that purpose. Stranger yet, the one barrier common to all present forms of helicopter operation—cost—need never be faced if one is concerned with a pure rotary wing agricultural implement. It is hardly conceivable that anybody would mount a spray-rig on a Rolls-Royce, but somehow that is what is happening with present-day helicopters, which are primarily transportation vehicles being adapted for heavy duty farm work.

Beyond question the helicopter is completely capable of fulfilling the two basic requirements of crop control—absolute coverage and proper timing. An incidental but vitally important feature of helicopter coverage is that the fungicide is swirled under and through the crops by the rotor downwash.

Abnormal weather conditions which would normally ground



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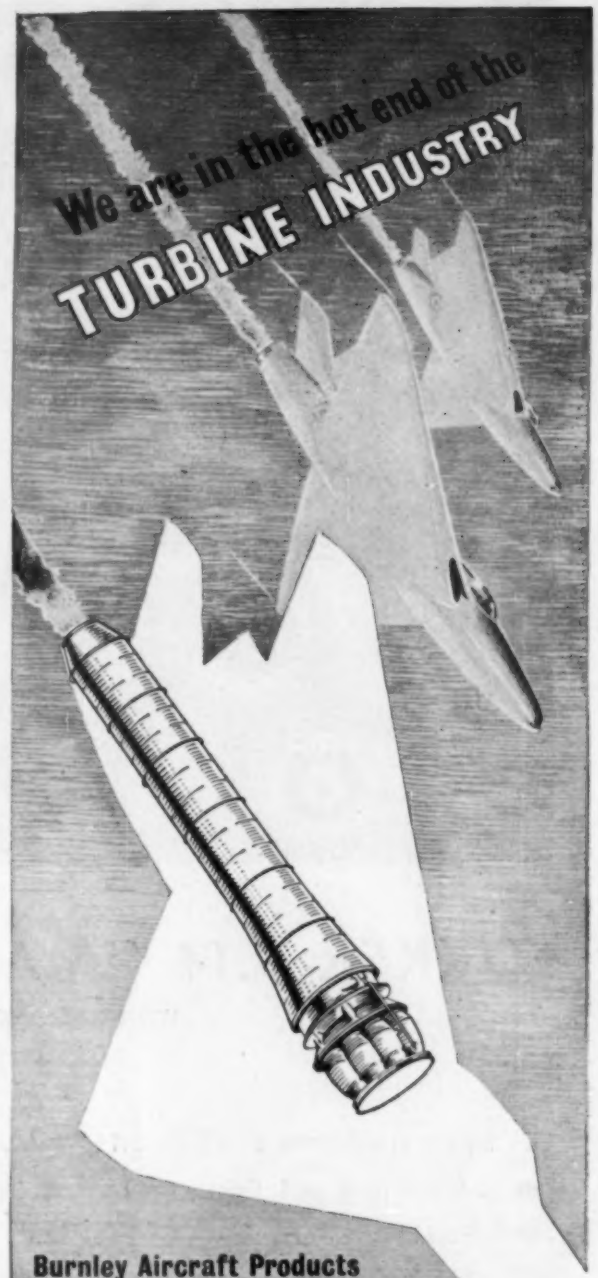

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AGRICULTURAL CONTROL BY AIR . . .

conventional aircraft impose no restrictions on the helicopter, the danger from low ceilings and bad visibility being almost nil. Moreover, the aeroplane for obvious reasons cannot operate at night, whereas the helicopter nearly always guarantees a 24-hour control.

From the viewpoint of the actual time involved compare an aeroplane and a helicopter that will each carry a similar load. The aeroplane landing strip may be miles away while the helicopter can always be refuelled and re-loaded immediately adjacent to the field. The former requires much more space for manœuvring after each pass at the field, whereas the latter need never cross the perimeter. Flight time for the fixed-wing aircraft is roughly 70 per cent for manœuvring and 30 per cent for dusting, whereas the rotary winged machine consumes only about 10 per cent of its time manœuvring, 90 per cent being spent over the operating area. In other words, nearly three times the acreage can be dusted by helicopter as can be treated by aeroplane in the same time. The average helicopter duster covers about 100 acres per hour.

The helicopter causes far less nervous strain on the pilot and requires fewer amendments to aviation law to go about the business of crop control.

What, then, is holding up the helicopter for this most necessary occupation? The answer is cost. Few farmers can justify the expensive operating costs of the helicopter in view of the wholesale value of the crops they produce. The reason is that so far the only helicopters available are those designed for purposes which require that they meet the high performance and safety standards imposed upon them by their primary duty. Even so, and in spite of the price of available helicopters, experience has shown that the actual operating expenditure is comparable to that of the fixed-wing aircraft, while the helicopter's proven advantages are to an increasingly large extent counter-balancing the initial expense.

Crop dusting is a highly competitive business run by men who must count shillings and pence, or they go out of business. There are, therefore, many specific problems which must be settled by the helicopter industry before we can hope for the widespread use of rotary wings in the war against insects and plant disease and in other farming directions.

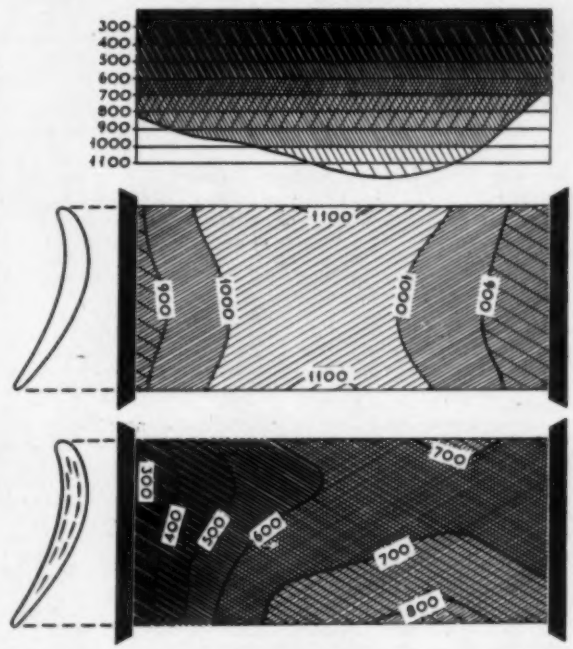
EXTRUDED NIMONIC BLADES

IN spite of the fact that the Mond Nickel Co., Ltd., have continuously developed and extended the range of Nimonic high-creep-strength, high-temperature alloys to meet the incessant demand of gas turbine development, blade cooling can offer rewards as great today as it could ten years ago. If the turbine stator blading alone is provided with internal cooling it is possible to obtain considerably more thrust, with better efficiency, from a given turbojet without greatly modifying the remainder of the engine and without reducing the life of any component. Even greater increases are possible if the turbine rotor blades are cooled.

The cooling of rotor blades is particularly difficult, and the methods attempted include the boring of blind radial holes along each blade to hold a small quantity of water or a molten metal like sodium, which circulates under the combined influences of variation in density with temperature and very high acceleration load. The cooling of both rotor and stator blades can be achieved fairly easily by making the blades from sheet, formed to a hollow aerofoil section up which cooling air can be passed. It is also possible to make blades by casting or by sintering them (press-forming from powder), so that passages for a cooling flow are provided in the interior—although such blades do not have mechanical properties equal to those attainable by forging. Other cooling methods include "sweat-cooling," and liquid-cooling by thermo-siphoning.

In the opinion of Mond Nickel, air cooling is preferable at the present time, and this is certainly the most simple and convenient method in practice. With the firm responsible for the production of Nimonic blades, Henry Wiggin and Company, Ltd., great efforts have been made to determine the optimum method of manufacturing blade sections with axial air passages. At the same time, considerable research into production processes and techniques has been required as a result of the ever-increasing difficulty of forging the latest Nimonic alloys. One of the reasons for this is that, as each new alloy has been developed, the difference between the operating temperature (at which the material must be stiff) and the forging temperature (at which it must be malleable) has diminished.

An extrusion process has now been perfected which extends the range of composition of alloys which can be commercially worked,



The upper diagram shows the heat distribution in degrees Centigrade across a typical turbine stator blade. The middle drawing shows the surface temperature over a solid stator blade (the thick black lines at left and right indicate the end attachments of the blade). The bottom diagram shows the corresponding temperature distribution of a cooled blade of the section shown on the left of the diagram.

Eight typical blade sections extruded in Nimonic alloy, showing various arrangements of cooling air passages.

by breaking down the coarse ingot-structure to improve forgeability, so that ordinary hot- and cold-working can be resorted to for final finishing. For some time, the Zenith Works of Henry Wiggin have been producing Nimonic aerofoil sections by hot extrusion and subsequent rolling. A wide variety of sections (illustrated) can be made, and it appears that the arrangement of cooling passages is limited only by the operations involved in machining the original billet. The particular means whereby these unusual forms are extruded cannot yet be disclosed.

The second illustration shows a typical surface-temperature plot and heat distribution for a stator blade, with and without air cooling. Clearly, the internal cooling either makes possible the selection of an inferior, and cheaper, alloy for the blade, or else permits a great increase in through gas temperature—and, in an engine, a corresponding increase in output. Cooled blade sections are at present being made in Nimonic 80A and Nimonic 90, offering all the characteristics of these alloys with respect to resistance to oxidation and thermal shock, but making these properties available for service with still higher gas temperatures.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Power Training for Glider Pilots

THE letter from Peter Fletcher (in your correspondence columns of July 30th) regarding power flying training for glider pilots has proved of considerable interest to the Popular Flying Association and some of its affiliated groups.

It would appear that a very practical test of Mr. Fletcher's theories could be achieved at a rate considerably below that quoted as a typical club rate by utilizing the services of one of our co-ownership groups.

Briefly, if Mr. Fletcher or his gliding club will provide, say, six "guinea pigs" from among their prospective glider pilots for training to solo stage on a suitable type of powered aircraft, the Association will undertake to find a group to train them at minimum cost. The solo-stage pilots could then be returned to the gliding club and the rest of the theory could be translated into practice by Mr. Fletcher and/or his fellow instructors.

This appears to be one case where an ounce or two of practice can be worth a ton of theory. The Popular Flying Association is prepared to co-operate wholeheartedly in any scheme of this nature should it prove a practical proposition. The more people who learn to fly either powered aircraft or gliders and sailplanes the better for all concerned who have the interests of private flying at heart.

London, W.1. M. O. IMRAY,
Secretary, Popular Flying Association.

Service Training for Airline Pilots

WHEN I was in England last year, there was for a time a controversy over the shortage of airline pilots for the future. I seem to remember several points of view being put forward by your readers regarding the problem of training airline pilots.

I thought you might be interested in an advertisement, enclosed herewith, from a New Zealand newspaper. The idea of airline pilots being given at least their first training by the Service seems to have met with the approval of interested parties in this country. Leaving the Service and entering the airline at Wings standard should enable a man to adapt himself to the peculiarities of airline flying before he becomes too ingrained with Air Force methods.

Such a scheme should also be possible in a country like Britain, especially where the lads are required to do two years' National Service. I understand that, at present, those wishing to enter aircrew under the National Service scheme must sign for three years instead of the usual two, probably because the Service wants to get it's money's worth out of someone who has been trained at the country's expense. However, it doesn't seem unreasonable that this third year could be spent as the first of what would eventually be an airline career. The service could still have call on the man in time of war, which it would have anyway.

Kaweau, North Island, N.Z. H. E. KIMPTON.

[The advertisement, by New Zealand National Airways Corporation, invited applications from men of under 25. "No previous flying experience is required," it says. "Successful applicants will be trained by the R.N.Z.A.F. and will join the Corporation's staff on passing the Wings examinations."—Ed.]

On Russia's Airlines

I WAS most interested in your article (July 23rd) on Russian civil aviation. It may interest you to know that I spent a month in the U.S.S.R. earlier this year and during that time I travelled extensively by Aeroflot. My first journey under the care of this organization was from Prague to Moscow in an Il-12—having flown to Prague in a DC-4 of Sabena and enjoyed the comfort and service that this airline offers. I must say that, from a passenger's point of view, I found the Aeroflot machine wanting in every respect. Flying at an average height of 6,000ft the machine was either excessively hot or very cold—dependent, it seemed, upon the whim of an unsmiling, un-uniformed hostess. Refreshment in the form of lemon tea was provided, but not until I had asked for it—and *that* in German.

The furnishing was dull and uninteresting, brown being the predominant colour. The seating was of the armchair type and, in an upright position, reasonably comfortable. The toilet facilities were very poor—a general feature in the U.S.S.R. The Russian idea of personal comfort appears to fall far below our standards.

My other air journeys were undertaken in the Dakota-type aircraft (here the Russians were most emphatic that these aircraft were *not* American). These included flights from Moscow to Rostov-on-Don, Sinoferofal, Kharkov (and other cities in the Ukraine), Minsk and Leningrad.

All the airports I visited were dual-purpose—that is, both civil and military; most had only a single runway, but all had great numbers of military aircraft: long rows of fighters, and what I took to be fighter-bombers of about Canberra size. I was not permitted to wander around the airports. I was, rather, hustled from waiting-room to aeroplane with the minimum of delay—however, much could be seen from the air, for hangar space appeared to be in short supply.

Air travel seems to be quite the usual thing for internal travel and my fellow-passengers ranged from a farm labourer to an actor of repute (in the U.S.S.R.). There is only one class of travel.

I had the good fortune to be in the Red Square on May Day and had an excellent view of the proceedings, including the fly-past led by a rather large four-jet bomber. When I mentioned the word "bomber" my interpreter raised his eyebrows and asked: "Who said it *was* a bomber?"

London Airport. CHRISTOPHER J. WHYTE.

Women in Early Aviation

I WAS reading the other day, with much interest, Patricia Stroud's article (August 20) on the part women have played in the air.

I was rather surprised, though, at two things she did not mention. She did not, for example, give the Hon. Mrs. Assheton-Harbord the credit of being the first Englishwoman—as she actually was—to obtain an official Aero Club ticket as a balloon pilot. Mrs. Harbord was an ardent and well-known balloonist in our famous early days at Hurlingham and Ranelagh, and taught herself to be a really accomplished balloon pilot.

Then there is the question of the first woman in the world to go up as a passenger in an aeroplane. Your contributor mentions the short "hop" which Mme. Thérèse Peltier made as a passenger with Delagrange in a Voisin biplane at Milan. But just prior to that, in that same year of 1908, Mrs. Hart O. Berg—wife of one of the principals of the syndicate which arranged for Wilbur Wright to bring a Wright biplane over to France for demonstrations before the military authorities—went up with the great Wilbur himself in a flight which really *was* a flight, lasting as it did for five minutes or more. And so far as I can vouch for it, as a lifelong student of flying history, the credit of being the first woman in the world to fly as a passenger in an aeroplane does without question go to Mrs. Berg.

Epsom, Surrey. HARRY HARPER.

FORTHCOMING EVENTS

Sept. 7-12. S.B.A.C. Farnborough Display and Exhibition ("Public" days, 10th, 11th and 12th).
Sept. 9-12. Royal Aero Club: International invitation air rally, White Waltham.
Sept. 13-19. Battle of Britain Week.
Sept. 16-17. Aerodrome Owners' Association: Annual Conference, Northampton and Sywell.
Sept. 18. R.A.F. "At Home" Day.
Sept. 25. Low-Speed Aerodynamics Research Association: Conference on model aerodynamics (at 4, Hamilton Place, London, W.1).
Sept. 25-26. Aero Club of Germany: Hanseatenflug international rally.
Sept. 20-29. Fédération Aéronautique Internationale: 47th annual general conference, Istanbul.
Sept. 29. British Institution of Radio Engineers: "Computing Circuits in Flight Simulators," by A. E. Cutler, B.Sc., Ph.D.
Sept. 30. R.Ae.S. Graduates' and Students' Section: "Air-to-Air Photography," by Russell Adams.
Oct. 11. Institute of Transport: Presidential address by Sir Gilmour Jenkins, K.C.B., K.B.E., M.C., M.Inst.T.
Oct. 12. R.Ae.S. Section Lecture: "Behaviour of Light Alloys at Elevated Temperatures," by B. C. Gadd.
Oct. 15. Rochester Flying Club: Annual dinner and dance, Bearsted.
Oct. 15. Helicopter Association: "Application of Gas Turbines to Helicopter Propulsion," by J. Brown.
Oct. 15. The Airlines Ball, Royal Albert Hall, London, 8 p.m.-2 a.m.
Oct. 19. R.Ae.S. Graduates' and Students' Section: "The Propeller-Turbine in Airline Service," by T. M. Corson.
Oct. 21. R.Ae.S. Main Lecture: "The Development of Reheat," by J. L. Edwards.
Oct. 26. Institute of Transport: Visual aids meeting: films on air transport.
Nov. 10. Institute of Transport: Anniversary luncheon.
Nov. 12. Helicopter Association: "Helicopter Production," by E. J. Boulger.

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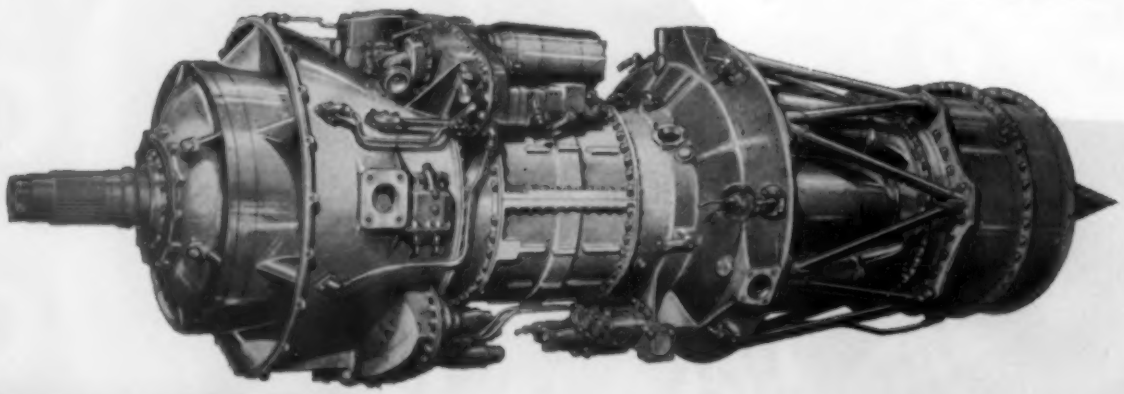

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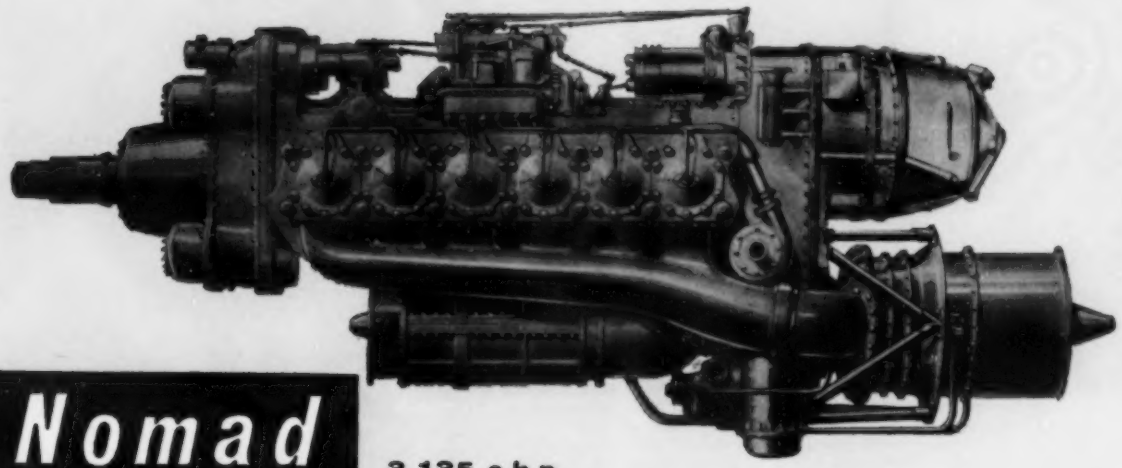

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★ *The Republic F.84F*
THUNDERSTREAK *fighter*

The Handley Page
VICTOR *crescent-wing bomber*

★ *The*
MARTIN B57 *(Canberra) bomber*

★ *The North American*
FURY *fighter*

★ *The Douglas A4D*
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"FLIGHT"
Photographs

The Hunter F.1 and a Swift F.2 standing in front of the recently completed weighbridge hangar.

AIRCRAFT TO WEAPONS SYSTEM

The Work of the A. and A.E.E., Boscombe Down

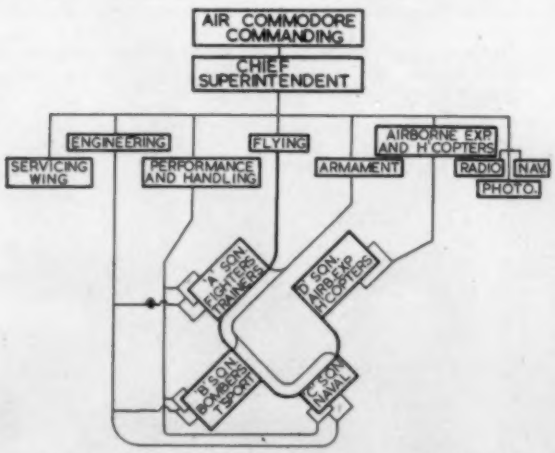
EXPERIMENTAL establishments dealing with military aircraft are quite rightly shrouded by thick curtains of security and are seldom known in the outside world by anything but their name and location. The Ministry of Supply's Aeroplane and Armament Experimental Establishment at Boscombe Down in Wiltshire is one such place. New aircraft "go to Boscombe" at various stages of their development and emerge some time later either with or without a new excrescence or two. It was not until last month that the gates of Boscombe Down were opened to allow an invited party of visitors to see what goes on there.

The Ministry of Supply had arranged an extensive demonstration and exhibition to show how the Establishment works and what it aims to achieve. Broadly speaking, its principal objective can be defined as the determination of the effectiveness and suitability of all new aircraft, and their armament and equipment, destined for the fighting Services. While other M.o.S. establishments deal with basic research, the A. and A.E.E. studies the complete product and aims to pass it on to the Services as an efficient and complete article. The word "article" is used advisedly, since an aircraft can no longer be judged solely as a flying machine; the airframe and engine are only a part of a weapons system which must include airframe, armament, equipment, sighting mechanism, and pilot. It is no longer possible to design an aircraft and subsequently to fit it with guns, bombs, rockets, radar and other equipment for any rôle to which the Service may think fit to apply it. In the near future it will be necessary to produce an aircraft for one specific purpose and therefore to design it around a given armament and guidance system. The three must be developed concurrently and complementarily. At present this stage has not quite been reached, but aircraft such as the Hunter, Swift and Valiant are very close to it.

It is the A. and A.E.E.'s job to evaluate each new aircraft and to check its performance; and the complexity of this task was made evident during our visit.

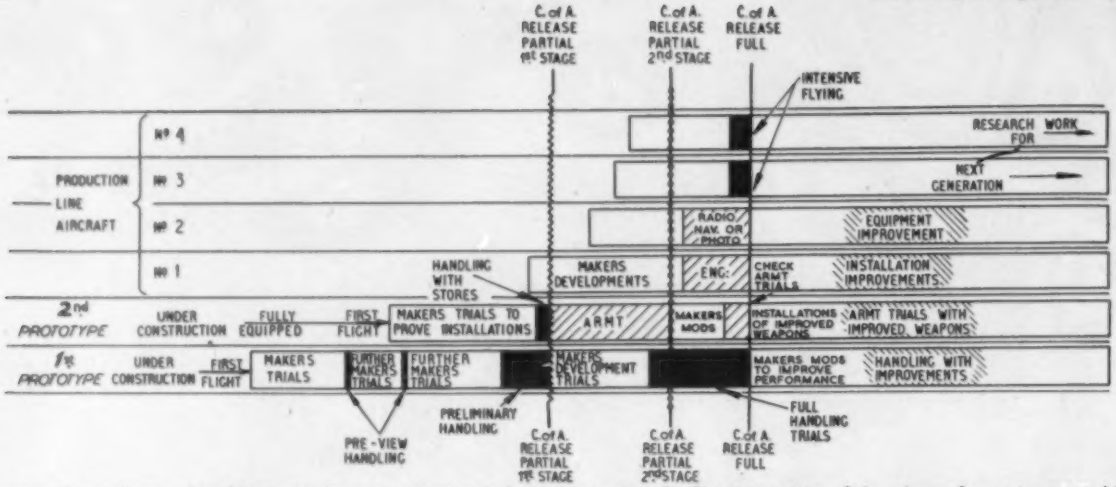
The Establishment was first formed in 1917, when a fighter squadron was brought back from France and established at Martlesham Heath for the purpose of testing all new aircraft delivered to the Services. Initial tests were quite simple and consisted mainly of establishing that the aircraft would, in fact, fly satisfactorily. As machines developed, however, the tests of necessity became more and more complicated, until finally, after World War II (and by which time the unit had moved to Boscombe Down) testing had become a scientific process applied to verify and fill out the test pilots' conclusions about a new aircraft.

The Establishment is now, therefore, divided into a number of departments centred round four flying squadrons, A, fighters and trainers; B, bombers and transports; C, naval; and D, airborne experimental and helicopters. There is a separate servicing wing manned by Service personnel which looks after the various mechanical needs of the squadrons. Finally, there are the engineering, performance and handling, armament, airborne experimental



The technical sections and flying squadrons of the A. and A.E.E., showing how the work of all of them is closely related and co-ordinated.

In the weighbridge hangar the Sapphire Hastings, on the scales, is surrounded by Hunters, Meteor and Dakota, and a visiting Cygnet.



Sequence of manufacturers' and Boscombe Down tests and trials for each new aircraft. The time-spacing of the releases-for-service granted by the Controller of Aircraft will, of course, depend upon the progress made by the prototypes concerned.

AIRCRAFT TO WEAPONS SYSTEM . . .

and helicopter, and radio, navigation and photographic departments, all of whose activities are co-ordinated with those of the flying squadrons. Almost all the pilots are drawn from the R.A.F. or the F.A.A., and most have passed through the Empire Test Pilots School. A large proportion of the technicians and "boffins" at the Establishment are, of course, civilians, and it was particularly stressed that one of the essential factors in the smooth functioning was the close co-operation which had been built up over many years between the flying and scientific personnel and between the Services and civilians.

Boscombe Down also undertakes the evaluation of certain items of equipment, and for this purpose a number of unusual test-bed aircraft are employed. These, and other types still on the secret list, or not yet in general service, make the aircraft population of Boscombe one of the most interesting in the country. Among the mentionable types observed during our visit were an Armstrong-Whitworth Apollo, the Sapphire-Hastings, an Avro Ashton and an Ercoupe.

Many aircraft which are already in service were also to be seen there, and their presence can be explained by a description of the approximate sequence of events between the construction of a prototype and its entry into full service. As the accompanying diagram shows, the A. and A.E.E. takes a constructive interest in new aircraft even before the first prototype flies.

Their first physical contact with it comes during the contractor's (i.e., the manufacturer's) initial trials, when a small team from the Establishment will examine and fly the aircraft in order to obtain their first impressions of it.

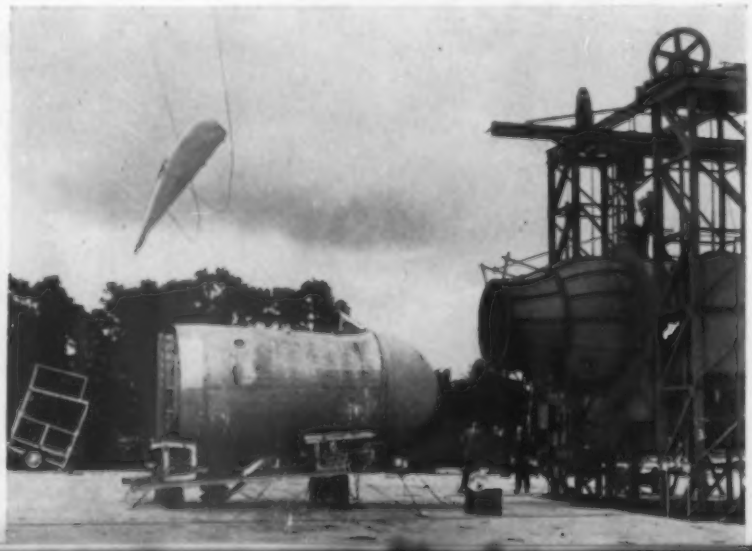
When such initial snags as may have been discovered by the makers have been eliminated, the first prototype is sent to Boscombe Down for preliminary handling assessment, after which it achieves the first stage of partial release. The first prototype is usually not equipped with armament; but at about this time the second protoype, with armament, will have flown, and will be assessed for handling with load. The first prototype then continues handling tests, both by the contractors and at Boscombe Down, until it gains its partial release, second stage; meanwhile, the second protoype will undergo full armament trials.

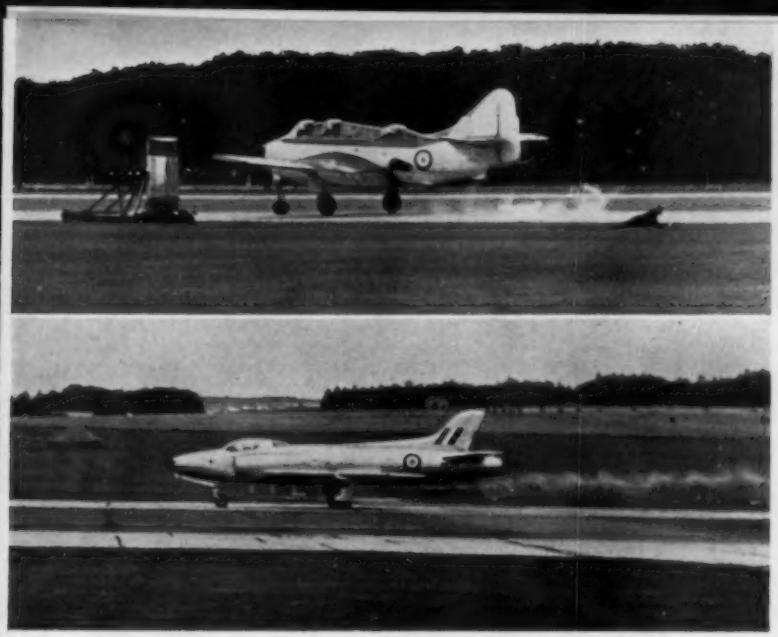
By this time, production aircraft will probably be appearing, and the flight departments at Boscombe Down will then make their own investigations of, for example, the engineering, radio, navigation and photographic qualities of the type. By the time the first half dozen production machines have arrived, the aircraft should have its full release and be ready for issue to the squadrons. In some cases, the squadrons receive the aircraft with a partial clearance which stipulates that they will not, for example, use their armament or some other equipment until the full release is granted. Finally, when the aircraft is in service, still further trials are carried out, both by the contractors and at Boscombe Down, to improve performance and armament and to prepare for the next generation. Aircraft already in service return for development testing after full release, as shown in the diagram above.

Of the time taken by trials, it can be said that for an average aircraft some 18 months to two years will elapse between the first flight and full release. There are those who maintain that Boscombe Down is a delaying factor in getting aircraft into service; but at the Establishment itself it is claimed that, though the first aircraft in service may be slightly delayed, the hundredth will arrive more quickly and prove more satisfactory in operation because of thorough testing.

Boscombe Down airfield itself is one of the largest and best equipped in the United Kingdom. It has two runways, one of which is 3,400 yd long and 100 yd wide; comprehensive lighting equipment is installed and the latest G.C.A. and homing aids are available. The modern laboratory, office and hangar buildings are still being extended, and a small pre-fabricated township houses many of those who work there. The station, incidentally, boasts a prosperous farm comprising some 320

(Left) The canopy of the Vulcan flies clear under the 250-m.p.h. blast from the blower tunnel. The nose section has a cone which maintains an airflow substantially the same as that on the actual nose of the machine. (Right) The Seamew, on initial handling trials at Boscombe and bearing modifications already described in "Flight", circles the control tower like a control-line model.





(Top, left) The Gannet touches down after a mirror-directed approach for an ADDL. (Above) The Swift F.2 shortly after touchdown, leaving its trail of vented fuel. (Top, right) The Hastings leaves a closely packed stream of cargo parachutes as the photographic Harvard peels off.

acres under cultivation and about 300 pedigree pigs. The farm is, not unexpectedly, fully mechanized.

The A. and A.E.E. must, of course, find out about behaviour of new Service aircraft in climates less temperate than our own, and for this purpose airfields in tropical, arctic, humid and clear-weather regions in Africa and Canada are used. A tropical testing unit is maintained at Khartoum; but now, because of the political situation in that area, it is likely to be moved elsewhere. Cold-weather tests are carried out in Canada by an R.A.F. lodger unit at the R.C.A.F. Winter Experimental Establishment. These trials used to be carried out by the R.C.A.F., but have since been taken over by the R.A.F. unit. Humid conditions are found in Mombasa, but there is no need to maintain a special unit there. Where continual clear weather is required for certain trials Idris in Tripoli is used.

On arrival at Boscombe Down for the recent visit we were greeted by A. Cdre. A. H. Wheeler, O.B.E., M.A., who commands the Establishment and who was formerly a test pilot and O.C. Flying at the R.A.E., Farnborough. A. Cdre. Wheeler and the Chief Superintendent, Mr. Handel Davies (formerly head of the Aerodynamic Flight at the R.A.E.), explained the purpose and organization of the Establishment. A demonstration was then given of the briefing—and subsequently also of the de-briefing—of a pilot for a test flight to establish certain aspects of the effectiveness of powered ailerons on the Venom F.B.4. The pilot was S/L. P. Thorne, and the "boffin," Mr. D. Hickton, asked him to test aileron control at high Mach numbers; if time allowed, he was also to try manual reversion —the switch-over to manual control. S/L. Thorne was to carry out a Mach run at full power up to 0.9 Mach, first noting the fuel state (for subsequent aircraft weight calculations) and trimming at 0.8 Mach. Instruments would record control surface angles and stick forces, and the pilot was to pay particular attention to the wing dropping at the onset of compressibility; he was to pull out with sufficient g to keep the Venom on the buffet and then try again at greater heights.

At the de-briefing after the flight, the pilot reported a considerable improvement in comparison with the F.B.1. There was, he said, a complete lack of lateral rocking at high Mach number and he considered the aircraft was a usable gun platform at a Mach number 0.05 higher than before. At this limit, a very strong nose-up trim change appeared, which he was unable to hold, but which he considered an excellent safety factor in speed control. The flight path during the nose-up trim change resembled a "hump", the top rounding off as the speed fell off in the zoom. Lateral rocking could easily be held with half the available stick movement, and it was possible to do a 60-deg banked, 2 g turn under full control at high Mach number.

The pilot had made five dives. Hussenot photographic strip recordings made in flight clearly showed the "hump" and subsequent recovery. Manual reversion at 250 and 300 kt gave no trouble and control thereafter, though heavier, was not uncomfortable. A manual landing had also been made without difficulty. After this initial de-briefing, the photographic records were to be interpreted in detail and a report made.

The next port of call was the weighbridge hangar, a very large new structure measuring some 250ft × 200ft × 60ft with

An A. and A.E.E. scientist, Mr. Hickton, sees off S/L. Thorne, whom he has just briefed for a test flight in a Venom F.B.4.

electrically operated folding doors (by Esavian) at each end. The building is equipped with special lighting and heating apparatus, and the central section of the floor is occupied by a weighbridge (by Samuel Parsons, Ltd.) capable of weighing up to 120 tons. It consists of three weighing platforms of 55, 55 and 10 tons capacity respectively, mounted flush with the floor, but movable on hidden tracks to allow for any undercarriage configuration. The smallest platform can also be raised 10ft or lowered 3ft. The weight resting on each undercarriage leg can thus be measured and the total weight and longitudinal c.g. of the aircraft ascertained. By tilting the tail or nose with the aid of the small platform the vertical c.g. can also be found. The weighbridge is accurate to plus or minus 5lb at maximum weight. At the time of our visit, a Sapphire-Hastings was "on the rostrum." Distributed around it were a series of Hunters, the Fairey F.D.1, a Dakota and a visiting General Aircraft Cygnet.

From the new control tower we then witnessed a flying display of representative Boscombe types. First away was Mr. Stewart in the Avro 707C, taking off for tests of the effect of delta stability on gun-sighting. S/L. J. Sowrey departed noisily in a Hunter 2, to be followed by a Canberra P.R.7 for which a lodger unit, part of the Handling Squadron, was preparing pilot's notes. The pilot, F/L. Rees, simulated engine failure on take-off to establish the P.R.7's critical speed.

A Swift F.2 (F/L. Varley) then landed downwind, leaving the increasingly familiar trail of vented fuel behind him. Finally, a Naval circus became airborne, consisting of a Gannet and a Wyvern (both on armament trials), Sea Hawk, and the second Seamew (on initial handling trials). While the Seamew circled the control tower at 70 kt, for all the world like a control-line model, the remainder of the circus formed up in echelon and came in for a stream landing with the aid of the new mirror device. They had collected a Venom F.A.W.21 on the way round, and flew over to make a 15-second break, arriving at 30-second

A Westland H.A.R. Mk 2 Whirlwind disgorges its load of troops down a 40ft scrambling rope by the airfield signals area.

AIRCRAFT TO WEAPONS SYSTEM . . .

intervals on the 3-deg beam of the mirror for "touch-and-go" landings. The mirror, incidentally, is a great improvement over the human "batsman," since it can be seen at 1,500 yd (twice as far as the batsman) and thus gives the pilot a longer run-in, during which he can adjust his speed and obtain an accuracy of plus or minus 2ft on the glide-path.

As the Naval circus cleared the area, an Ashton with long-range tanks took off for a navigational trial and was followed by the arrival overhead of a Hastings, closely accompanied by a photographic Harvard. A stream of cargo hampers on coloured parachutes was dropped from a new type of roller-conveyor discharge system, a very concentrated grouping being achieved. The final item was the disembarkation down a 40ft scrambling rope of five fully equipped men and one package of equipment from a camouflaged Whirlwind H.A.R. Mk 2 helicopter. In addition to the five men and full equipment, the helicopter carried a crew of two, pilot and despatcher. This is a technique successfully employed in Malaya by the Naval helicopter squadron for landing troops in areas too overgrown for a helicopter touch-down.

One of the types of test carried out at Boscombe Down consists in assessing the emergency escape and jettisoning devices of new aircraft. For this purpose, a device called a blower tunnel is used. This machine in fact resembles a monster hair-dryer and consists of four Merlins each driving a ten-bladed fan, all mounted head to tail in a duct which can be adjusted for height and angle, producing a 220 kt airstream 6ft wide, or a 290 kt airstream 4ft wide. With two of the Merlins idling a smooth flow of 60 kt is the minimum attainable. This jet of air is directed over the required portion of the aircraft to assess the trajectory, after jettisoning, of such items as cockpit canopies and wing tanks. Human escapes from hatches and cockpits into safety nets are also tried. At the time of our visit, a Vulcan nose-section was set up, and to the accompaniment of the shattering roar of four Merlins, the metal canopy was jettisoned and its trajectory photographed. The canopy was retrieved undamaged by a system of cables and counterweights.

The Merlins used in the tunnel are recovered from disused Service aircraft all over the country, overhauled in the workshop and test-run in the nose of an old Barracuda which is tethered nearby. On normal tunnel tests, the Merlins are run for a matter of seconds only at +15 lb boost. The jet of air from the 6ft nozzle has been found to be substantially even up to a diameter of 8ft over the whole speed range.

A static display set up in the Electrical and Instrument Building showed some of the great variety of scientific work which goes towards recording and interpreting the results of all the various tests. The recording instrument most used in flight test is the French Hussenot photographic strip recorder, and special machinery is being developed to produce a precise interpretation of its graph-like records as quickly as possible. The flight is only one phase of a test. The required measurements must first be stipulated. The recording instruments are then prepared, and installed in the aircraft—no mean task when space is restricted—and after the flight the results are interpreted and assessed and recommendations made. A great deal of the static exhibition was therefore taken up with "black boxes" designed to record such things as gas concentration in gun bays, vibration, aircraft flight data, control-surface movement and stick forces, and radio aerial efficiency.

All the departments require their own special data, and a great deal of work goes into the development of special instruments to make the necessary recordings. For instance, one phase of tests was devoted to the establishment of cockpit temperature and humidity conditions to establish whether a pilot could be expected to operate an aircraft in certain climatic conditions without suffering such physical discomfort that his efficiency would be seriously impaired. In modern aircraft, this can be a critical problem, since it is all too easy for cockpit temperatures to rise or fall to such an extent that the pilot would, according to aviation medicine standards, be incapable of carrying out an operation. Closely allied with this comes the problem of windscreen de-misting, which is generally done by hot air. Where other research agencies decide the desired maximum and minimum temperatures for a cockpit, Boscombe Down tests each aircraft to see that the limits are not exceeded, or, if they are exceeded, recommends corrective measures.

Where each item of electronic equipment in a particular aircraft may have been separately assessed, Boscombe Down will test the working of a number of items in the same aircraft, first for efficiency and safety and then for such factors as interference between the different units and possible overloading of the aircraft electrical system during combined operation of all of them. Aerial system radiations are plotted and wiring checked for possible snags due to fuel seepage or other unexpected eventualities. In addition, certain new items of equipment are assessed as, for example, I.L.S. and Zero Reader equipment being evaluated in a Pembroke.

The Airborne Forces Experimental Establishment, formerly at Beaulieu, was merged with the A. and A.E.E. after the war, and new methods of dropping men and equipment are tested at Boscombe Down or at the various ranges nearby. One item of airborne equipment being shown was a new quick-release parachute harness, for airborne troops. In connection with helicopters, new problems in testing have arisen, due to the peculiarities of the machine, and special methods are being developed to deal with them.

First Aden Gun Demonstration

The highlight of our visit to Boscombe Down was an air-to-ground gunnery and rocket demonstration which included the first public firing of the new 30 mm Aden aircraft cannon. Under the auspices of the A. and A.E.E. Gunnery Technical Section, three targets were laid out for the afternoon's sport at the Imber range, consisting of a group of five lorries and two Spitfire 22s. The whole programme was part of the normal armament tests of the Establishment, and automatic recording cameras and kine-theodolites were positioned close to the targets to record dive angles, speeds and other data.

Two Venoms first fired eight 3in rockets each in salvoes of two. Despite intermittent drizzle and an uncomfortably low cloud-base, they reduced the M.T. to a decidedly derelict condition. A Sea Hawk (4 × 20 mm cannon) and a Sabre (6 × 0.5in) respectively fired explosive and incendiary ammunition at one of the Spitfires, leaving it well punctured and sprinkled with earth but still in approximately recognizable shape. Once again, the superiority of the cannon over the machine gun was evident.

From a 25-deg dive a Swift F.1 then fired its two Aden guns with explosive rounds at the same Spitfire. This was considerably more noisy than anything we had heard to date, and the explosive rounds kicked up a great deal of earth—without, however, causing very much more damage to the aircraft.

The last Spitfire, painted yellow, was reserved for a Hunter F.1 with the full complement of four Aden guns. In all, the pilot fired three bursts before using up the Hunter's load of 100 rounds per gun; we presume, incidentally, that a bulge underneath the forward fuselage was a link collector box. The first burst was very noisy and kicked up a great deal of earth, but mostly went over the target. The next two bursts were much more effective than security regulations will permit us to describe in detail; suffice it to say that the Spitfire was utterly written off. We have never before seen such devastation achieved in so few seconds. Both the rate of fire and the destructive power of the new gun are greater than those of any aircraft cannon today, and its effectiveness is by no means underquoted as "nine times that of the 20 mm cannon."

Such, in one crowded day, is what Boscombe Down was able to show its visitors; and even this can be only a bare outline of the work which is undertaken all the year round by the Establishment. Our impression of the place was that a great number of people are efficiently performing an exceedingly complicated task as quickly as its inherent complexity will allow.

CIVIL AVIATION

LONDON TOWER: The new control building in the central area at London Airport is nearing completion. Controllers there will be provided with radar for supervising ground movements.

L.A.P. GROUND RADAR

LONDON AIRPORT'S new control tower, illustrated above, will, as reported in *Flight* of August 27th, be the first in the country to make use of radar for supervising ground movements. The equipment, to be installed early next year, is Decca Millimetric Radar operating on a wavelength of approximately 8 mm (Q band); it is designated A.S.M.I. (airport surface movement indicator) by the M.T.C.A., who outline its functions as follows: "(a) To let the air traffic control officer see for himself immediately the runway is clear for an aircraft to take off or land; (b) To assist in directing rescue vehicles to aircraft which may be in trouble on the ground and cannot be seen from the control tower owing to bad weather conditions; (c) To enable the controller to see by radar where aircraft and vehicles are along the taxiways, so that he can expedite ground movements with greater safety than heretofore."

The Ministry add that it is at present not intended, nor considered feasible, to give A.S.M.I. guidance to all aircraft and vehicles; the centre-line taxiway lighting and stop-bars will continue to guide taxying aircraft in all but the worst weather. As experience is gained, it is hoped to devise new techniques designed to make the radar still more useful.

The new set has a narrow horizontal beam of 23 min and a short pulse rate of 0.05 micro-seconds. It was selected, say the M.T.C.A., because of "its good general picture quality with sharp delineation of runways and taxiways and its high discrimination." The Ministry's opinion is borne out by the accompanying illustration, reproduced from a photograph taken during recent trials at London Airport.

SABENA'S HELICOPTER ANNIVERSARY

LAST week saw the completion of a successful first year of passenger carrying by the Sikorsky S-55s of Sabena. Some interesting figures were given by the company's managing director, M. Willem Deswarte, on September 1st, the anniversary of the inaugural service. The Sabena scheduled international helicopter services, he said, had carried almost 13,000 passengers and made 3,500 flights. A further 5,000 passengers had been carried on non-scheduled flights. In 1924, M. Deswarte recalled, the Belgian airlines carried a total of only 1,700 passengers. Not until 1933 was the number of passengers carried (12,544) comparable with the total who travelled by the helicopter network. He revealed that regularity had been as low as 61 per cent in December, but said that the average regularity was 83 per cent and that the peak had been reached in recent months with 93 per cent.

By regularity is meant the number of trips completed in proportion to the number scheduled. The regularity of scheduled services by major airlines is usually around 99 per cent; Sabena's helicopter results, though encouraging, indicate that there is still a good deal of room for improvement. The prime reason for cancellation of flights, and for the fact that departures over the year were on average five minutes late, is undoubtedly the present inability to operate helicopters under I.F.R. conditions.

BREVITIES

A UNITED AIR LINES order for 17 DC-7s will increase the company's fleet of these aircraft to 27 and brings the number of DC-7s sold by Douglas to a total of 107. United Air Lines have also ordered ten DC-6Bs and five DC-6A Liftmasters.

* * *

Dutch merchant and naval craft are dragging the North Sea off Ymuiden for wreckage of the K.L.M. DC-6B lost on August 25th. The depth of water in the area of the wreck, which was located on August 25th, is about 60ft. An engine was recovered on August 31st.

* * *

An Air France Constellation was severely damaged when it ran off the runway while landing at Gander on August 25th. There were no serious injuries among the 58 passengers and nine crew.

* * *

To be used on a "special project," one of the nine Martin 2-O-2s formerly operated by Pioneer Air Lines (and now being offered for sale by William C. Wold Associates) has been leased on a long-term basis to its manufacturers, the Glenn L. Martin company.

* * *

November 15th is now given as the inaugural date of the S.A.S. Polar service from Copenhagen to Los Angeles which has recently received U.S. State Department approval for a period of three years. It is expected that flying time between Copenhagen and Los Angeles will be about 26 hr and that the single fare will be in the region of £215.

HELIBUSES: Sabena's fleet of four seven-seat Sikorsky S-55s, which have carried 13,000 people in their first year of scheduled passenger services. Brussels is the focal point of a network linking Antwerp, Liege, Lille, Rotterdam, Maastricht, Cologne and Bonn.

CIVIL AVIATION . . .

Among the airline executives attending the S.B.A.C. Show is the president of United Air Lines, Mr. W. A. Patterson, who is making his first visit to Europe. His point of arrival was Copenhagen, whence he was due to continue his journey to London by B.E.A. Viscount. He is accompanied by vice-presidents Robert E. Johnson and R. W. Ireland.

* * *

A new booklet describing the comprehensive world services to air transport provided by International Aeradio, Ltd., is intended as a source of reference for government and transport officials, and deals in turn with planning and consultancy, operations, engineering services, supplies, training, specialist staff services, and the well-known Aerad flight guides, trunk route manuals and other publications. The company's head office is at Aeradio House, 40 Park Street, London, W.1.

In a *Notice to Licensed Aircraft Engineers and to Owners of Civil Aircraft* (No. 11, Issue 3) the A.R.B. state that the Cirrus Minor II cannot be run at full throttle below 2,050 r.p.m. without detonation; the use of any airscrew permitting a static r.p.m. below this minimum can result in cumulative damage to this engine.

* * *

P.A.W.A. announce that more than 70 major airlines have joined their "pay later" plan, whereby a 10 per cent deposit covers airline travel as well as hotel accommodation, sight-seeing tours and ground transport, the balance being paid by monthly instalments. In this country Hunting-Clan Air Transport, Ltd., have announced that they hope to be the first British airline to introduce instalment travel; many details have yet to be settled but it is hoped to inaugurate the scheme, providing for payment over a period of five or six months, early next year.

FROM THE CLUBS

Seen at Alencon last month at the annual light aircraft rally of the Reseau de Sport de l'Air (a report of which will appear in a forthcoming issue) were the C.P.30 Emeraude (left) and Jodel D112.

OVER 100 guests in 43 light aircraft were expected to arrive at White Waltham yesterday (Thursday) for the International Invitation Air Rally organized by the Royal Aero Club. For the first two days of their stay, the visiting pilots and passengers are the guests of the Club at Maidenhead: a dinner and a dinner-dance at the Guards Boat Club have been arranged, and today (Friday) the visitors are due to attend the S.B.A.C. Show at Farnborough. Tomorrow and Sunday they will be the personal guests of individual members and associate members of the R.Ae.C., and will fly to their hosts' aerodromes (these include Cambridge, Old Warden, Southampton, Panshanger, Sherburn-in-Elmet, Southend, Fair Oaks, Lympne and Thruxton).

Among the visiting aircraft types are a number of American designs, including Cessna 170s, Navions, Ercoupes, Pipers and Beech Bonanzas, in addition to K.Z.3s and K.Z.7s from Denmark, Major Bremer's Junkers Junior from Finland, Mr. R. Uges' Sokol M.I.D. from Holland, the New Italian Pasotti F.6 Airone, and a sprinkling of Messengers, Geminis, Proctors and Austers.

BOTH Luton Flying Club and Yeadon Aero Club experienced bad weather for their respective "At Homes" recently. At Luton, twelve visiting aircraft arrived, some from as far as Elmdon and Leicester. Miss Joy Durham, of Elstree, won the time-of-arrival competition, and Vic Lea (Auster) won the *Concours d'Elegance*. An aerobatic display by Ranald Porteus in the Aiglet Trainer preceded the cancellation of the remainder of the programme as the cloud-base came down almost to ground level. Yeadon's longest-distance visitor was Mr. Thomas Bell (Auster) from Newcastle Flying Club; the arrival contest was won by Mr. Riddell from Sherburn; and among the other visitors was Mr. C. G. Wheatley, of York, in a Temco Swift. Ground entertainment during the afternoon included a driving competition for members and guests. The Yeadon club's flying hours for the first six months of this year total 610, and the club fleet now consists of four Austers, one Tiger Moth, and two Rapides. Members' private aircraft comprise two Miles Geminis and one Proctor.

The first flight of the newly-formed R.A.F. Thorney Island flying group: W/O. Crossman, the S.W.O., boards Magister G-ALFE.

PILOTS and other enthusiasts in the Southport area who are interested in group-membership flying are invited to contact Mr. W. D. Bold, honorary secretary of the Southport Aero Club. The club, which was formed in July 1951, has encountered much difficulty in its search for an airfield, but with the help of the M.T.C.A. has been successful in obtaining the use of Hesketh Park Aerodrome. Mr. Bold's address is 70 Princes Street, Southport.

THANKS mainly to the enthusiasm of S/L. D. T. Lees, M.C., an R.A.F. officer at Thorney Island, a flying group (Popular Flying Association Group No. 31) has recently been formed on the station. The group's first aircraft, Magister G-ALFE, was flown on its delivery flight from Fair Oaks to Thorney Island by S/L. Lees on August 21st, and began its club life the following day.

Membership of the new group is about equally divided between qualified pilots and airmen normally engaged on ground duties. The charge for dual instruction is at present 30s per hour, but it is hoped eventually to reduce this to nearer £1.

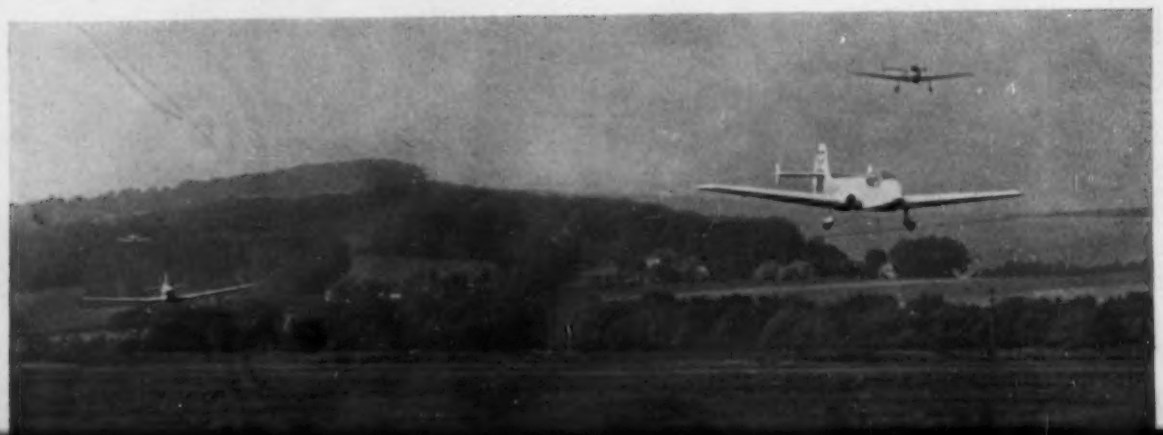
The group is the first to operate on an R.A.F. station under the Popular Flying Association scheme—narrowly beating the Tangmere R.A.F. group now being formed. What appears even more remarkable is that, immediately prior to the Thorney Island group's formation, there was not a single R.A.F. flying group or club in existence affiliated either to the P.F.A. or to the Association of British Aero Clubs. This absence of flying clubs in an Air Service is obviously a matter of serious concern. The lack of Air Ministry support—though a contributory cause—is certainly not the only reason.

For the record, we might add, without comment, that the Royal Navy, Royal Artillery, the Household Brigade of Guards, and the Royal Engineers—and, as recently reported in *Flight*, the R.C.A.F. at North Luffenham—each have their own flying clubs.

AT SHOREHAM

THE races at Shoreham, reported last week, provided a good finale to the year's competitions—because they left one wanting to see more. In our opinion, they also confirmed that a race of several laps of a short circuit—not more than 20 miles—around an airfield suits pilots, aircraft and spectators alike. In these pictures are seen, right, R. Porteous cavorting in the smart red Aiglet demonstrator; below, the line-up of competitors and, in the hands of Mrs. A. S. Bishop, wife of the company's sales director, the Goodyear Trophy itself. The three bottom pictures show J. M. Donald beside the Tiger Moth in which he won the first heat; Captain J. Christie's Globe Swift, once again over-handicapped, being checked; and the hazy scene at the airfield turning point during heat two with Dunkerley's Sparrowjet just ahead of Phillips' Proctor 3 and Westbrook's Messenger, and the Swift behind.

"Flight" photograph



SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

The Duke's Heron

IT has now been officially announced by the Air Ministry that a de Havilland Heron Mark 2 will be delivered to the Queen's Flight and that it will replace one of the Vikings which have been used for the past few years. It is further announced that the Heron will be piloted by the Duke of Edinburgh on many of his official visits.

Biggin Hill Drumhead Service

SEATING for 5,000 people is being provided for a drumhead service of commemoration and thanksgiving to take place at R.A.F. Station Biggin Hill on Battle of Britain Sunday, September 19th. The service will start at 11 a.m. with the processional arrival of the Lord Bishop of Rochester (the Right Rev. C. M. Chavasse, O.B.E., M.C., D.D.). A Spitfire and a Hurricane, to be dedicated by the Bishop, will remain permanently on either side of the new gateway being built at the entrance to the St. George's Chapel of Remembrance. Subsequently there will be a fly-past by twelve Meteors and an address by the Bishop. Lessons will be read by the Air Officer Commanding-in-Chief Fighter Command, Air Marshal Sir Dermot Boyle, K.C.V.O., K.B.E., C.B., A.F.C., and the station commander, W/C. D. G. Smallwood, D.S.O., M.B.E., D.F.C.

In order that seating may be provided for all wishing to attend, requests should be forwarded to the officiating chaplain, Major the Rev. V. Symons, M.A., The Vicarage, Biggin Hill, Kent. If this notification is given applicants need not wait for a ticket as suitable arrangements will have been made for them.

Canadian Joint Staff Appointment

SUCCEEDING A. Cdre. M. Costello, who has held the post in London since June 1951, A. Cdre. A. D. Ross, G.C., C.B.E., C.D., is the new Air Member, Canadian Joint Staff, London.

A. Cdre. Ross joined the R.C.A.F. in 1928 and at the beginning of the war was in command of No. 5 Bomber Reconnaissance Squadron, engaged on anti-submarine duties. He came to England (Middleton St. George) in 1942 and it was while on this tour of duty that he was awarded the George Cross. While landing from a raid over Germany a bomber crashed into a bombed-up aircraft on the ground. Despite fire and exploding bombs he and one airman rescued the pilot and assisted in extricating the rear gunner. He was severely wounded, losing his right arm.

PRODUCTION PRECURSOR: It was announced in May this year that a Ministry of Supply production order for "about a hundred of a military version" of the Bristol Type 173, a prototype of which is seen on a recent development flight, had been placed. Obviously the basic 173 design could be adopted for anti-submarine operations as well as for general transport duties.

Bombay Duck

INVOLVING the largest concentration of aircraft and naval ships seen in Ceylon waters for some years, Exercise Bombay Duck was recently completed. It was conducted by Vice-Admiral C. F. W. Norris, C-in-C. East Indies Station, in conjunction with A. Cdre. J. Cox, A.O.C. Ceylon.

In the concluding phase the ships of the Royal Ceylon Navy were considered as having been dispersed by an imaginary cyclone and were endeavouring, with their radar out of action, to return to Trincomalee from scattered positions 180 miles south-east of Ceylon.

The exercise provided some spirited action as the dispersed ships had been warned to expect attack from two hostile raiding cruisers, represented by H.M.S. *Ceylon* and I.N.S. *Delhi*, assisted by R.A.F. Coastal Command Shackletons operating from Negombo and Far East Air Force Sunderlands from China Bay. These aircraft reported to the raiding cruisers a number of sightings of dispersed ships. The attackers took full advantage of this information in subsequent actions when I.N.S. *Delhi* "sank" an Indian Navy destroyer and although the Royal Pakistan destroyer squadron carried out an attack against H.M.S. *Ceylon*, she was considered to have "sank" one of the destroyers and a tanker. Later the *Ceylon* itself had its speed reduced and three-quarters of her armament put out of action as the result of an attack by Short Sealands of the Indian Navy.

Aircraft Carriers

IN the latest list issued by the Admiralty of aircraft carriers built or under construction the Royal Navy is shown as possessing 19 and the Royal Australian Navy and Royal Canadian Navy a further two each. The United States has 103, Holland one and France three.

In Korea

IT may not be generally known that No. 77 Squadron, Royal Australian Air Force, is still maintained at operational readiness in Korea. The Squadron, the work of which was described in *Flight* of June 26th, 1953, recently moved back to an airfield about 100 miles south of its earlier base. Here from dawn to dusk each day an alert section stands by with pilots in their cockpits ready to scramble.

During a recent large-scale air defence exercise over South Korea, No. 77 Squadron distinguished itself by achieving a record of interceptions out of all proportion to its strength, and thereby earned a tribute from the United States 5th Air Force headquarters which exerts operational control over the Squadron.

Venoms for New Zealand Squadron

IT was recently announced by Mr. Macdonald, New Zealand Minister of Defence, that No. 14 Squadron, R.N.Z.A.F., is to be re-equipped with de Havilland Venoms.

When making this statement the Minister said that the policy of the United

OFF CENTAUR: From the starboard catapult of the carrier H.M.S. "Centaur" (Capt. H. P. Sears) a Hawker Sea Hawk is projected out over the bows. "Centaur" is the Royal Navy's first angled-deck carrier, but for the present does not have the new steam catapult.

Kingdom Government was to have squadrons in the Mediterranean area well equipped. (No. 14 Squadron has been based in Cyprus since 1952.) He went on to say that by arrangement between the Home and New Zealand governments the Venoms would be supplied on a hire basis. Mr. Macdonald gave the speed of the Venom as "near 600 m.p.h.," a figure which could easily be mistakenly read as meaning "less than 600 m.p.h."

R.C.A.F. Appointment

THE new A.O.C. Transport Command of the Royal Canadian Air Force is A. Cdre. H. M. Carscallen, D.F.C. He succeeds G/C. Z. L. Leigh, O.B.E., who has been acting A.O.C. since A. Cdre. R. C. Ripley, the former A.O.C., was appointed to the staff of A.A.F.C.E. last December.

British Empire Medal Award

THE *London Gazette* of August 31st announced that the Queen has been graciously pleased to award the B.E.M. (Mil.) to L. A/C. W. H. Andrews, who is serving at Binbrook, Lincolnshire.

The occurrence for which the award was made took place on April 2nd, 1954, when a Canberra, while taking off, went out of control and crashed, striking G.C.A. vehicles. One fuel tank was torn off and hurled into a truck where it exploded and threw burning kerosine over the site. This truck was immediately ablaze and, within seconds, the permanently attached G.C.A. prime mover, which was less than ten feet away, also caught fire. The wreckage of the aircraft was scattered around and the situation was confused and dangerous. The whole site was covered with kerosine burning fiercely around and under the vehicles.

L. A/C. Andrews, immediately appreciating the threat to the main G.C.A. installation, ran through the flames, climbed into the cab of the burning prime mover, backed out of the blaze and helped to extinguish the fire. This airman showed remarkable discipline and disregard for personal safety in a potentially highly dangerous situation. His prompt, cool-headed and brave action, says the Air Ministry, undoubtedly resulted in the saving of valuable equipment.

EVER-OPEN MAW: A Bristol Freighter of No. 137 Transport Flight, R.C.A.F., loading stores at the Royal Canadian Air Force air materiel base at Langar, Nottinghamshire.

Sir Francis Fogarty Touring East

IN an aircraft of R.A.F. Transport Command, Air Chief Marshal Sir Francis J. Fogarty, K.C.B., K.B.E., D.F.C., A.F.C., Air Member for Personnel, left London Airport on August 26th to start a tour of Middle East and Far East R.A.F. establishments during which he will also visit, at their invitation, the Commanders-in-Chief of the Royal Pakistan Air Force, the Royal Thai Air Force and the Indian Air Force. Sir Francis is due back in this country on October 1st.

A. Cdre. Prickman Retires

LAST Monday, September 6th, A. Cdre. T. B. Prickman, C.B., C.B.E., left Home Command prior to his retirement from the R.A.F. on October 4th, after 33 years' service. He has held the post of Air Officer in charge of Administration, Home Command, since June 1950.

At the outbreak of the war he was in command of No. 32 Fighter Squadron and during the Battle of Britain commanded the Fighter Sector and Station at Kenley, Surrey. He was afterwards at Headquarters No. 11 Group Fighter Command until June 1942, when he became an instructor at the R.A.F. Staff College. In September 1943 he went to Headquarters Fighter Command as deputy Air Officer i/c Administration, a post he held until a few days before the end of the war in Europe.

Reunions

A "SUNDOWNER" reunion of all staff officers who were at No. 5 F.T.S. R.A.F. Thornhill, Southern Rhodesia during 1951-54 will be held at Overseas House, St. James, London, S.W.1, on Friday, October 1st, at 1830 hr. Ladies are invited, and tickets are 30s double, 15s single, from F/L. W. H. W. Spencer, c/o Lloyds Bank, 6 Pall Mall, London, S.W.1.

* * *

No. 824 Squadron, Fleet Air Arm, hope to arrange a 21st birthday dinner and dance in London next December. All ex-officers are invited to communicate with the present commanding officer, Lt-Cdr. N. C. Manley-Cooper, D.S.C., R.N., at R.N. Air Station, Eglinton, N. Ireland.

* * *

It is intended to hold the 9th annual reunion of No. 3 Squadron of G.R. (Squires Gate) at the Casino, Blackpool, on Saturday, October 2nd. Particulars from A. C. M. Powell, Monterey, 26, Nth Promenade, St. Annes-on-Sea, Lancs.

* * *

The sixth annual reunion for officers, airmen and airwomen who served with No. 78 Squadron, and at the stations with which it was associated up to the end of 1946, will be held at the Albert Tavern, 52 Victoria Street, London, S.W.1, on Saturday, October 16th. Tickets and further particulars from F. Ivers, Kepcold, Ltd., 23 Carnaby Street, London, W.1.

* * *

The sixth M.R.E.S. Officers' reunion will take place in London on Saturday, October 30th. Particulars from S/L. P. E. Laughton-Bramley, M.B.E., 24, Hans Road, London, S.W.3.

AWARDED: (Left) Air Marshal Sir Owen Jones presenting a Squadron Standard to No. 11 Squadron, R.A.F., at Wunstorf. The Standard-bearer is F/O. J. B. Peart. (Right) A model of a Hastings C Mk. 3 presented by John Gamble, Ltd., New Zealand representatives of Handley Page, Ltd., to No. 41 Squadron, R.N.Z.A.F., on the occasion of a visit to Whenuapai by the new Chief of the Air Staff, A.V-M. W. H. Merton.

THE INDUSTRY

Redux in Film Form

THE Redux bonding process, introduced by Aero Research, Ltd., in 1942, is widely used in the aircraft industry as a structural adhesive for metals. The introduction of the adhesive in a new form, intended to contribute towards greater ease and economy in use, has recently been announced. This consists of the standard "Redux" liquid and powder supplied as a film, and has been designed particularly, but not exclusively, for bonding metal skins to metal honeycombs to form sandwich structures.

The film, which is covered by specification D.T.D. 775A, is supplied in rolls with protective covering, and has a storage life of at least six months. Tests to destruction at room temperature have shown the failing load on lap-joint specimens (20 s.w.g., D.T.D. 546, 1in wide and ½in overlap) cured under vacuum at 12 lb/sq in to be of the order of 4,100 lb/sq in. As the film ensures exact control of the proportions of Redux powder and liquid in the bond, strength at elevated temperatures is improved over that by previous methods. Further details may be obtained from Aero Research, Ltd., Duxford, Cambridge.

Permali and Hordern-Richmond Merger

THE directors of Permali, Ltd., announce that, subject to the necessary consents being obtained, a merger is to take place between their company and Hordern-Richmond, Ltd.

Mr. Lawrence Robson, chairman of Hordern-Richmond, will join the Permali Board.

Permali, Ltd., whose shares were marketed in February last on the London Stock Exchange, are manufacturers of densified wood laminates and Bakelized paper products, primarily for electrical insulating purposes, under the trade names "Permali" and "Dialam." Hordern-Richmond are well known in the aircraft industry as manufacturers of "Hydulignum" wood laminates and other products.

Mercast Process in U.K.

GUEST, KEEN AND NETTLEFOLDS LTD., and the Mercast Corporation of New York have formed a company under the name of Mercast (Great Britain) Ltd., to license firms in the U.K. and the British Commonwealth (excluding Canada) to use the Mercast process. This is a method of investment casting in which patterns of frozen mercury replace the more usual wax patterns, with the intention of obtaining closer tolerances, smoother finish and the ability to make more complicated and larger castings than are practicable with the lost-wax method.

The Mercast Corporation claims wide application for its process in the aircraft engine field in America. Hollow turbine blades and the Wright Turbo-Cyclone are particularly named. Mercast is also used for radar waveguides, for guided missile components and in atomic energy plants.

The chairman of the new company is Mr. G. R. Sankey, of Joseph Sankey and Sons, Ltd. The other directors are: Dr. T. Emmerson, of G.K.N. Group Research Laboratories, Wolverhampton; Mr. K. O. G. Huntley, of Lovell, White and King, solicitors, London; Admiral A. G. Kirk, U.S.N. (ret'd.), of Mercast Corporation; Mr. W. A. Nicol, of Guest, Keen and Nettlefolds, Ltd., and Mr. S. J. Sindeband, of Mercast Corporation.

The registered office of the new company is at Albert Street, Bilston, Staffs., and the technical manager is Mr. Christopher Dykes, M.A., M.S., A.F.R.Ae.S., A.F.I.A.S., M.S.A.E., who will continue to operate as an advising aeronautical engineer.

GODALMING TO CHELTENHAM: Mr. P. E. Felgate, B.Sc., A.F.R.Ae.S., A.M.I.E.E. (left), has been appointed chief development engineer (engine controls) at the Cheltenham factory of Smiths Aircraft Instruments Ltd. Previously he was chief development engineer, Waymouth Gauges and Instruments Ltd., of Godalming, a subsidiary of Smiths Aircraft Instruments. Mr. W. G. Smith (right) has now taken over that post.

Mr. Sidney Foster

WE learn with regret of the death of Mr. Sidney Foster, at the age of 57, on the eve of the twenty-first anniversary of his joining the Lockheed Hydraulic Brake Co., Ltd.

Following service overseas in the First World War, Mr. Foster worked on the design of the R.101 airship at Cardington, and later joined the Supermarine team under Mr. Mitchell at Southampton. In September 1933 he moved to Lockheeds at Leamington Spa, where his work on the development of undercarriage mechanism brought him wide recognition as an authority on the subject.

IN BRIEF

Thermal Control Co., Ltd., of Marine Works, Sackville Road, Hove, Sussex, announce that W/C. George Lowdell, A.F.M., has joined them in the capacity of project consultant (aviation). Well known as an instructor and test pilot since the early twenties, he was until recently chief production test pilot to Vickers-Armstrongs, Ltd.

* * *

An agreement has been concluded between Teleflex Products Ltd., of Chadwell Heath, Essex, and the Scientific Co., of San Francisco, U.S.A., under which the former company became British and Commonwealth licensees for the American company's control cable tension regulators.

FRANK DISMORE, D.F.C., who joins W. S. Shackleton, Ltd., next month as general manager. Well known since the war as manager of the Royal Aero Club's air touring department, and latterly as R.Ae.C. assistant secretary, Mr. Dismore has a distinguished war-flying record, first as an instructor and later on operations; in one year from June, 1944, he flew 359 hours on sorties against the Japanese. Under his management, W. S. Shackleton, Ltd.—who claim to be Europe's largest aircraft dealers—hope further to expand their activities.

Mr. Alan L. Stock, a director of Lodge Plugs, Ltd., has been appointed deputy chairman of the company. Col. Derek W. Pritchard has joined the Board.

* * *

Mr. Charles Watson, for many years chief sales engineer of British Ermeto Corporation, Ltd., Maidenhead, has been appointed a director of that company.

* * *

Mr. C. E. Slade, M.Inst.W., has left the service of Philips Electrical, Ltd., and is starting in practice as a consulting engineer specializing in resistance welding. His address is 11 Trowlock Avenue, Teddington, Middlesex.

* * *

Mr. Leonard A. Kingsman, who recently relinquished his position as publicity manager of the Bristol Aeroplane Co., Ltd., with whom he had served for 11 years, has been appointed to a senior executive position in the newly formed advertising and public relations division of the Central News, Ltd.

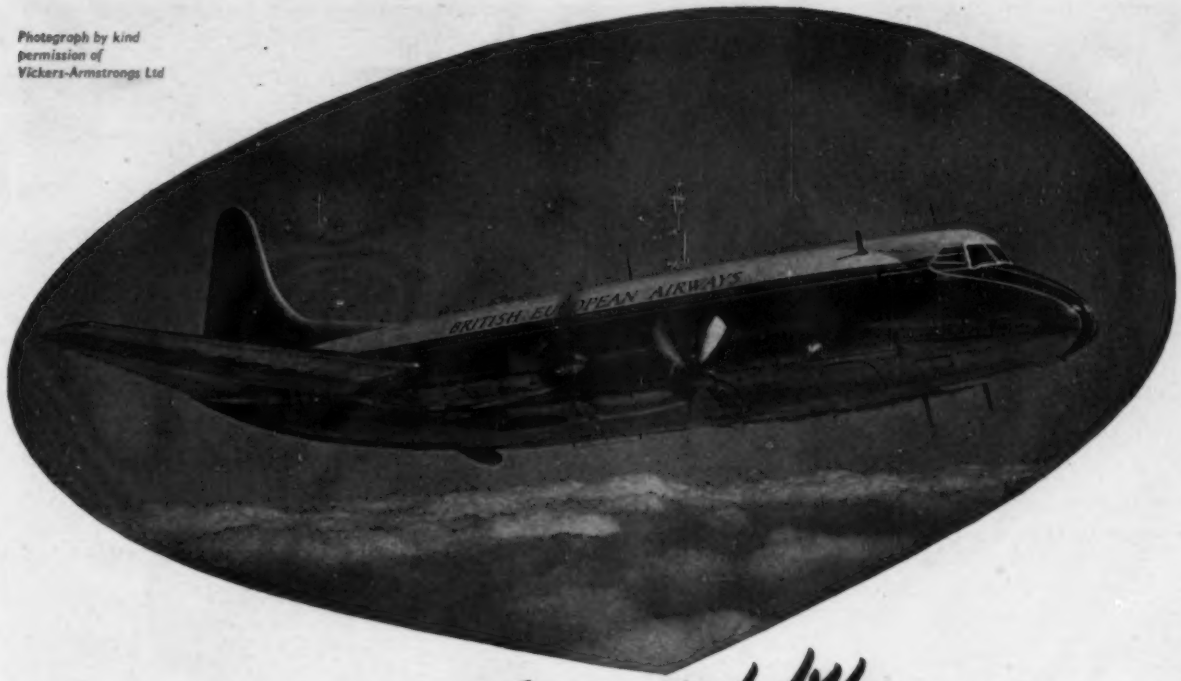
* * *

Entitled *Some Aspects of Industrial Noise and Vibration Measurement*, a 35-page illustrated treatise has been published by A. E. Cawkell, electronic engineers, of 6-7 Victory Arcade, The information that should be of value to aircraft research workers. Boardway, Southall, Middlesex. It contains a great deal of

* * *

A special display of Brush battery-driven industrial trucks has been arranged jointly by Brush Coachwork Ltd., of Loughborough, and J. R. Alexander and Co., Ltd., automobile distributors, to be held in the latter company's showrooms at 264 Great Western Road, Glasgow, C.4, from September 14th to 16th.

Photograph by kind permission of Vickers-Armstrongs Ltd



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Cold room tests

During approval tests by Rolls-Royce Ltd., a series of starting tests on the Dart propeller turbine engine were completed satisfactorily in the Cold Room of Rolls-Royce Ltd., at minus 25° C.

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400 amperes smooth direct current at 28 to 29.5 volts is also available for the testing of electronic gear, galley equipment, etc.

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HERE BEGINS THE A.C. AGE!

The one major obstacle to the much-needed change to Constant Frequency A.C. Systems in the air—the problem of satisfactory operation of alternators in parallel—has been overcome by the introduction, by ENGLISH ELECTRIC, of the Sundstrand Constant Speed Alternator Drive.

This Drive, in full and increasing production in the U.S.A. for several years, is in regular squadron service in the United States Air Force.

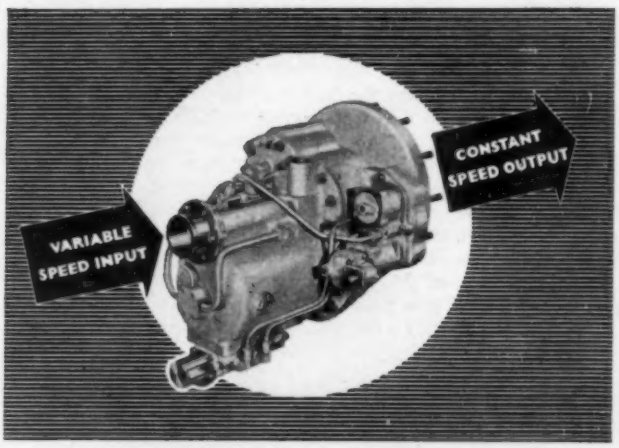
Now ENGLISH ELECTRIC, by manufacturing the Drive under licence in this country, are to add their own unrivalled experience in the design and engineering of A.C. power systems to the development work and production know-how of the Sundstrand Machine Tool Co. No organisation in this country has wider experience than ENGLISH ELECTRIC in the design and construction of all the component parts of constant frequency A.C. systems—alternators, transformers, switchgear, motors, etc.

THE SUNDSTRAND DRIVE

This constant-speed drive is a brilliant adaptation of an old and well proved system—the variable-angle hydraulic swash plate pump and motor—with this difference, that in the Sundstrand design the hydraulic unit is used differentially to add to, or subtract from, the input speed so as to maintain an output speed constant to 1% plus or minus over a speed range of 3 to 1.

WHAT THE A.C. AGE MEANS

Compared with D.C. Installations Constant Frequency A.C. Systems are much lighter, simpler, more reliable and efficient. High altitude operation does not involve the serious design problems and operational troubles as encountered with D.C. Equipment. The inherent simplicity of the A.C. Squirrel Cage motor is such that maintenance costs are enormously reduced if not altogether eliminated.



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Full details from 'ENGLISH ELECTRIC' AIRCRAFT EQUIPMENT DIVISION · Phoenix Works, Bradford

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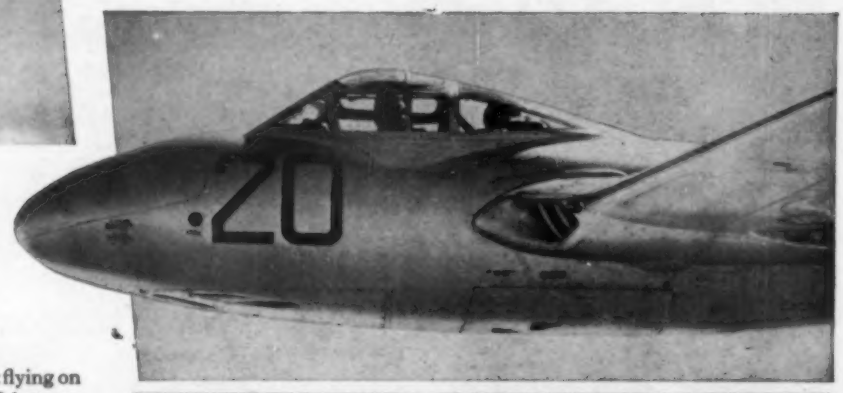

With the new flying training techniques now being introduced in the Royal Air Force, pupil pilots receive their advanced instruction on these 550 m.p.h. Vampire T.11 jet trainers. Offering side-by-side seating for pupil and instructor, and fully aerobatic, the Vampire T.11 is the perfect introduction to jet flying on which pupils can progress with confidence to the 'wings' stage.

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THE ROYAL AIR FORCE

AN OUTSTANDING REVIEW OF THE

Farnborough Air Display

IN THIS WEEK'S PICTURE POST

This is a great week for all who are interested in Britain's latest achievements in the air. For experts and amateurs alike, the Farnborough Air Display presents an unrivalled parade of the planes and pilots that have made this country famous in the air.

In honour of the occasion, this week's issue of Picture Post carries an important special feature on the highlights of this year's display. Its contents include:

★ A magnificent full-page colour photograph of the Avro Vulcan — the new delta-winged bomber.

★ Roly Falk — an intimate portrayal of the personality and achievements of the Vulcan's pilot, one of the most skilful test pilots now flying.

★ A photographic pre-view of the most important planes to be seen at Farnborough. Among those planes expected to take part are the Comet III, Viscount, Britannia, Supermarine 525, Hawker Hunter, Swift, D.H. 110, Canberra, Valiant and Victor.

For those who are going to the Farnborough Air Display — it is open to the public on the 10th, 11th and 12th of September — this special feature in Picture Post offers an invaluable guide to all that you will see there. To those who cannot be there, this week's issue of Picture Post is the next-best thing to seeing the display itself.

The Avro Vulcan bomber, seen here, will be taking a prominent part in the display. Piloted by Avro's Superintendent Flying, Roly Falk, it is the first 4-jet delta bomber in the world.

PICTURE POST

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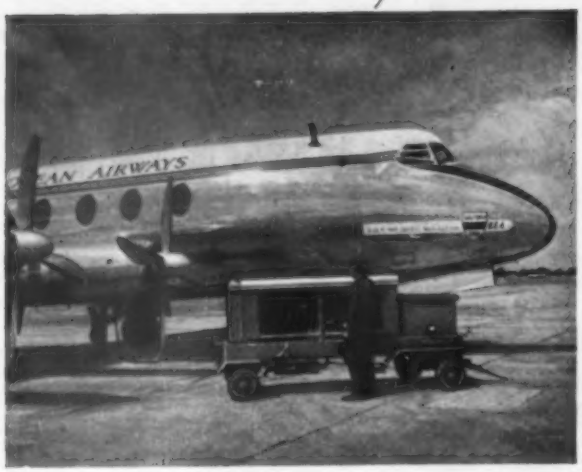

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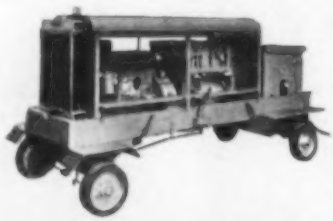

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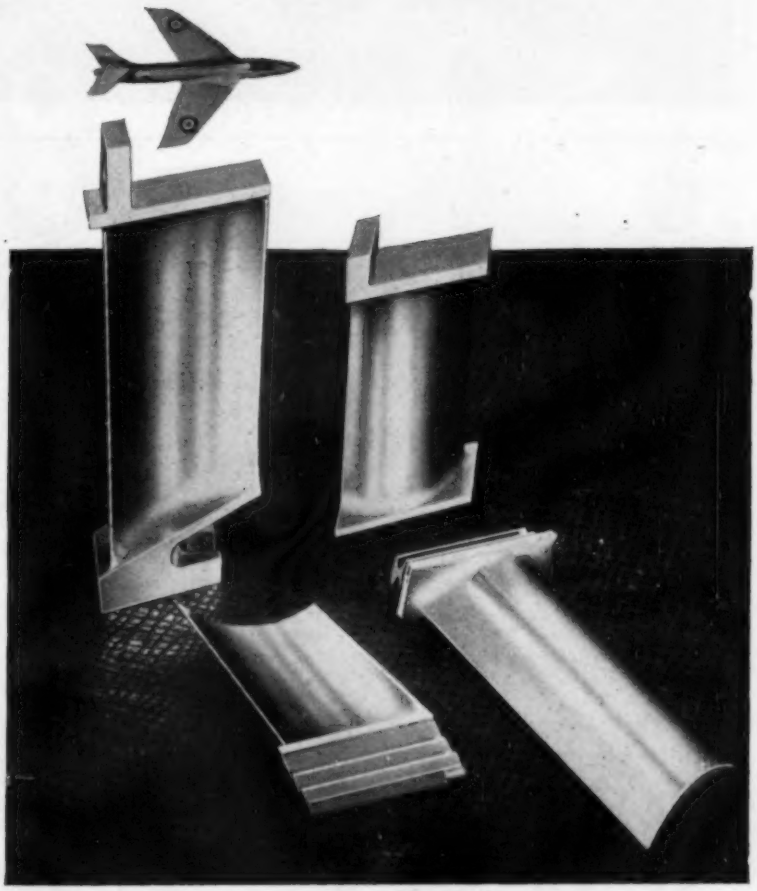

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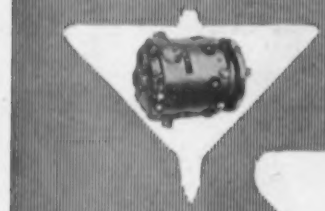

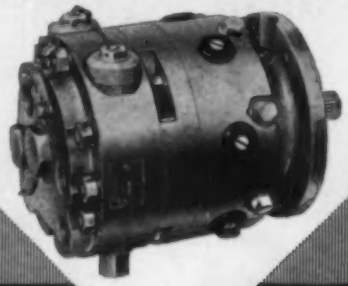

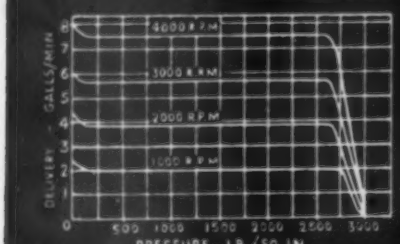

Curves show delivery/pressure characteristics for the pump type 130 Mark 5 illustrated

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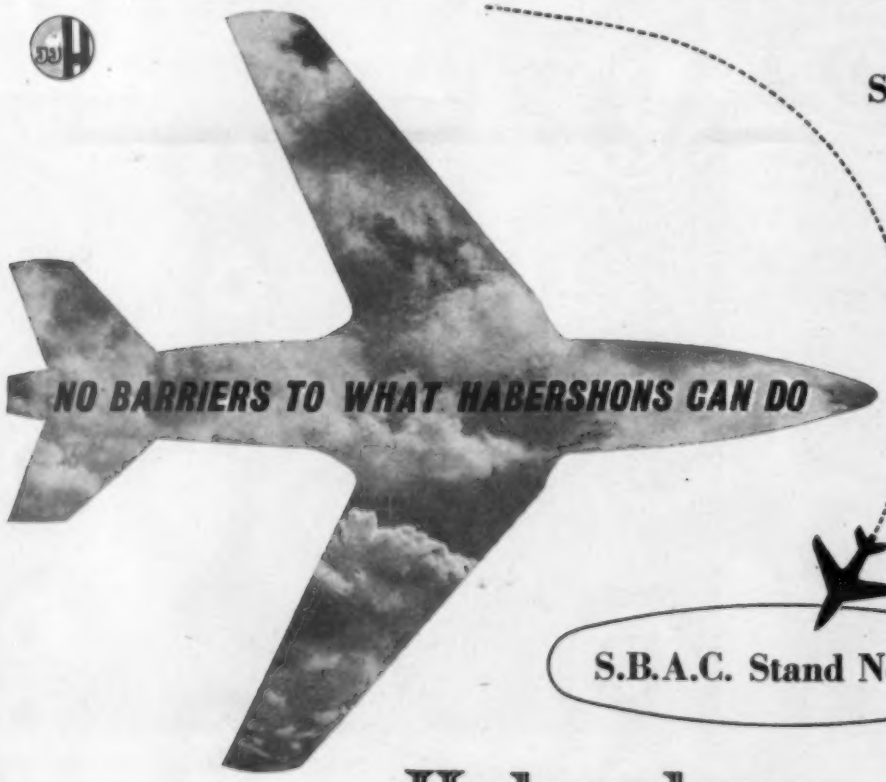

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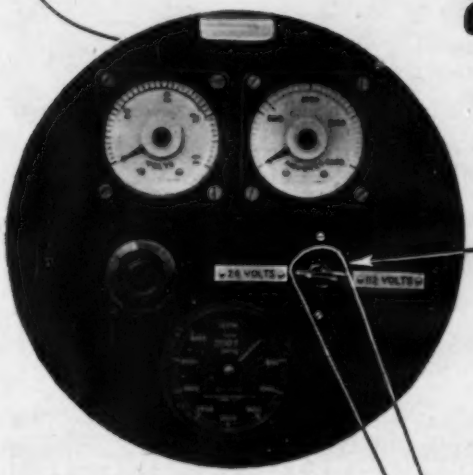

The illustration shows our type G.S.7. ground power unit. It incorporates a 6-cylinder ROLLS-ROYCE engine driving our specially developed dual voltage generator. The engine and generator are unit mounted making for compactness and perfect alignment. Two separate output cables are provided giving either 28 volts or 112 volts as required. The change-over is made by means of one small selector switch mounted on the control panel. All the most advanced protective devices are incorporated, to safeguard the aircraft and generating sets completely.

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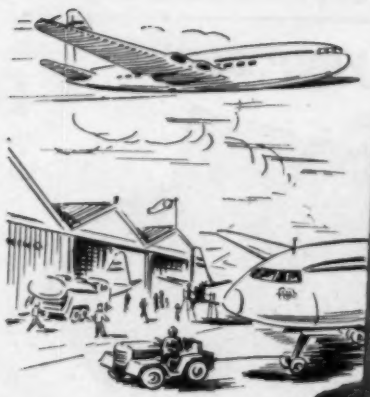

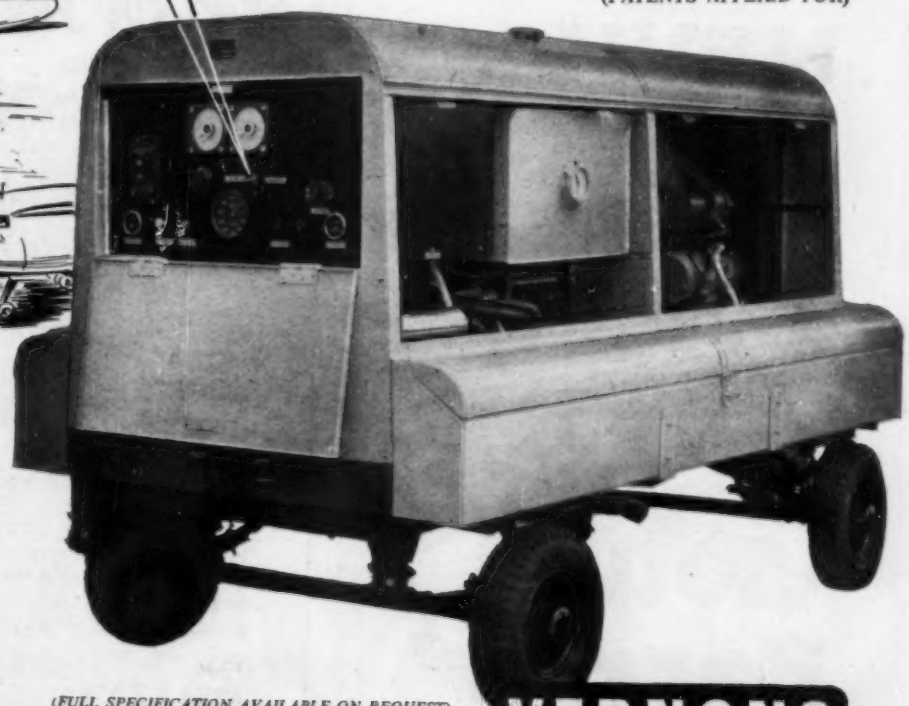

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Did you read this in "Flight" on August 20th?

(Boeing B.47E in the Air . . . by The Editor)

"The six throttles are easy to hold in the right hand and they move lightly and smoothly. This is another point which I have previously noticed with American aircraft I have flown—their throttle levers move very nicely, yet there is the hardly detectable friction to hold them at any point. Too many British aircraft—particularly the older ones—have stiff throttles, with back-lash."

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NEVILLE DUKE

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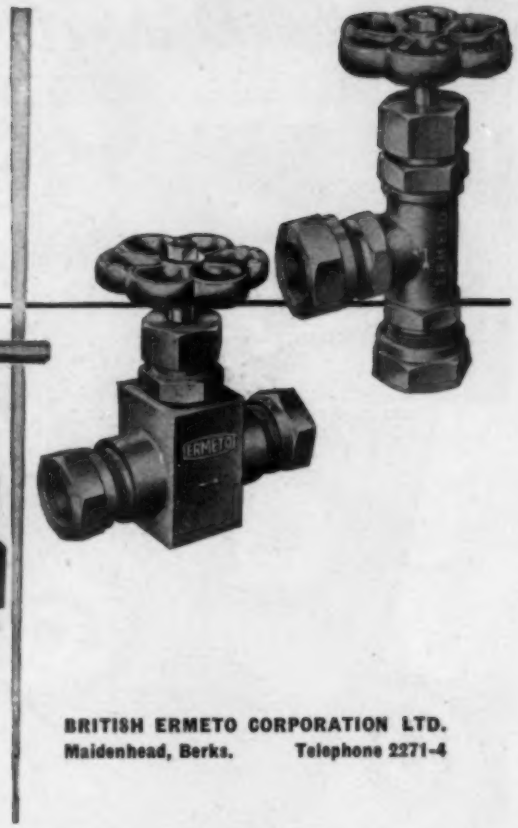

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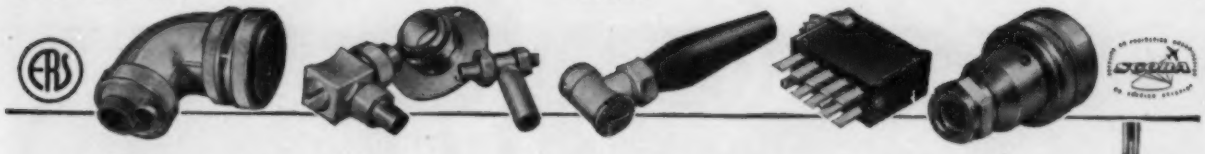

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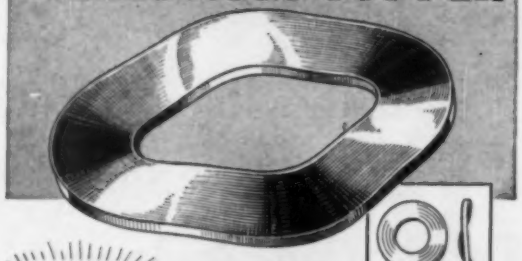

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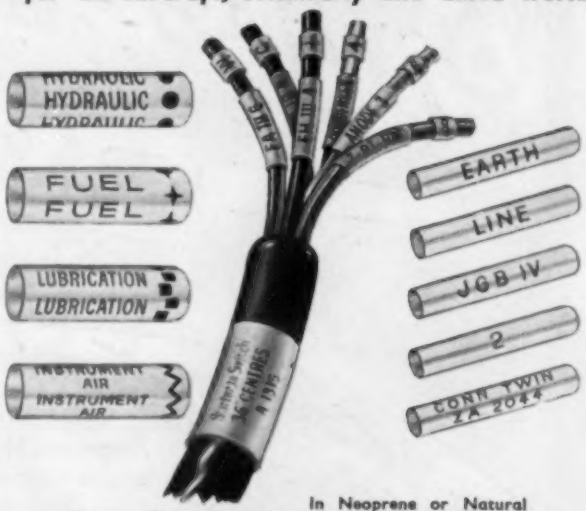

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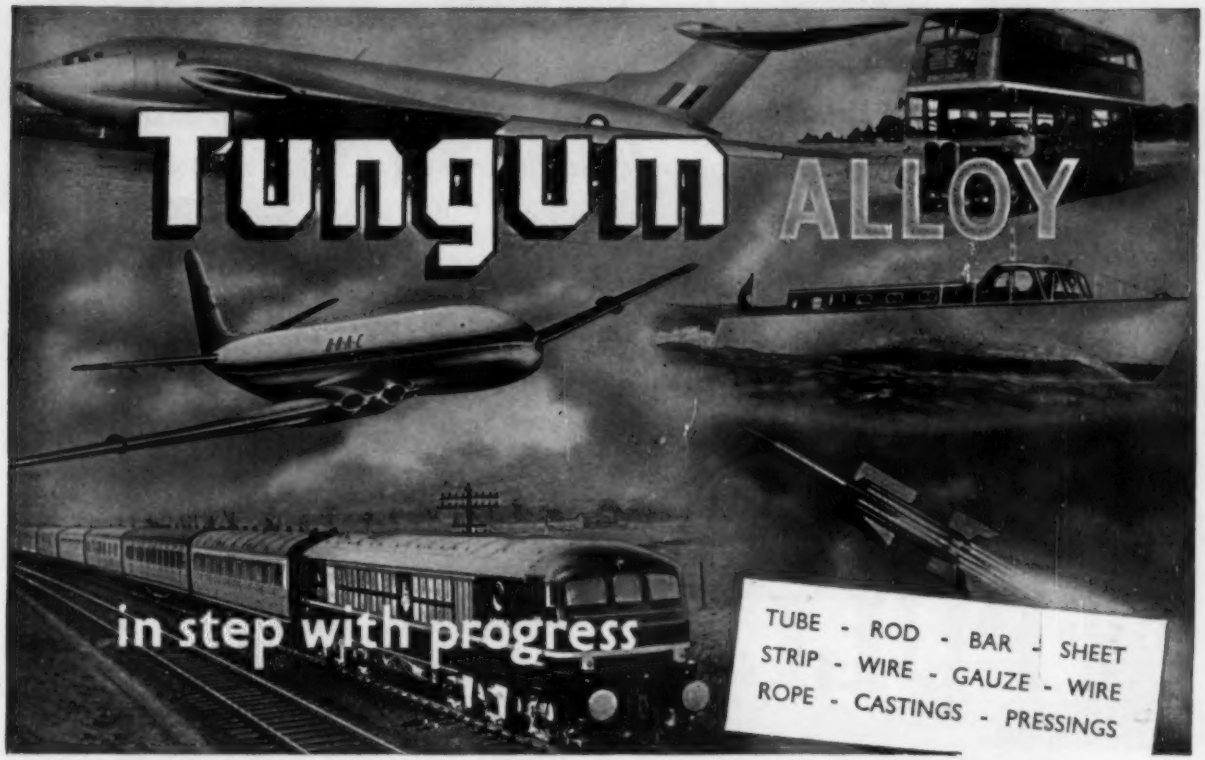

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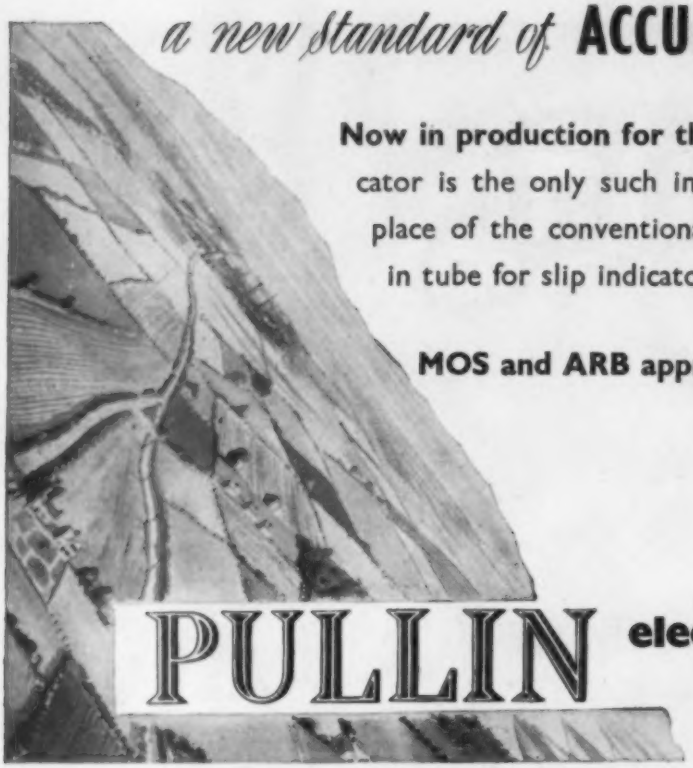

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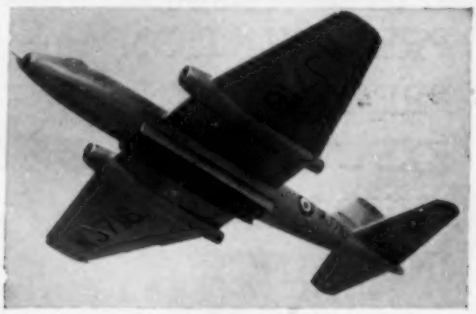

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM Air Kruise (Kent) Ltd., of Lympne Airport, Kent, for the following Seasonal Inclusive Tour Services with Dakota aircraft, to be operated in conjunction with Blue Cars Continental Coach Cruises Ltd., during the season from April to October inclusive for a period of seven years commencing April 1st, 1955.

Application No.	*Route*	*Frequency*
340	Lympne/Ferryfield-Albenga	Two services weekly
341	Lympne/Ferryfield-Venice	One service weekly
342	Lympne/Ferryfield-Biarritz	One service weekly
343	Lympne/Ferryfield-Barcelona	One service weekly
344	Lympne/Ferryfield-Copenhagen	One service weekly
345	Lympne/Ferryfield-Salzburg	Two services weekly
346	Lympne/Ferryfield-Basle	From seven to ten services weekly
347	Manchester-Ostend	From three to five services weekly

FROM Transair, Ltd., of Croydon Airport, Surrey:—

APPLICATION No. 348. For a Seasonal Inclusive Tour Service, in conjunction with Horizon Holidays, Ltd., with Dakota aircraft for the carriage of passengers and supplementary freight between London (Croydon or Gatwick) and Perpignan at a frequency of from one to three services weekly during the season from May to September inclusive for a period of seven years, commencing May 1st, 1955.

APPLICATION No. 349. For a Seasonal Inclusive Tour Service, in conjunction with Horizon Holidays, Ltd., with Dakota aircraft for the carriage of passenger and supplementary freight between London (Croydon or Gatwick) and Ibiza at a frequency of from one to three services weekly during the season from May to September inclusive for a period of seven years, commencing May 1st, 1955.

APPLICATION No. 350. From East Anglian Flying Services, Ltd., of Southend Airport, Southend-on-Sea, Essex. For a Seasonal Normal Scheduled Service with D.H. 89A aircraft and possibly later with D.H. Dove, D.H. Heron and/or Dakota aircraft for the carriage of passengers and supplementary freight and mail between Ipswich and Le Touquet with an intermediate traffic stop at Southend at a frequency of from seven to 21 services weekly with duplication of services as required during the season from April to October inclusive for a period of ten years, commencing April 1st, 1955.

FROM Starways, Ltd., of Speke Airport, Liverpool:—

APPLICATION No. 351. For a Seasonal Inclusive Tour Service, in conjunction with Cathedral Touring Agency, Ltd., with Dakota aircraft for the carriage of passengers between Liverpool and the Isle of Wight at a frequency of from one to three services weekly during the season from May to October inclusive for a period of ten years, commencing May 1st, 1955.

APPLICATION No. 352. For a Seasonal U.K. Internal Service, with Dakota aircraft for the carriage of passengers and supplementary freight between Liverpool and the Isle of Wight with an intermediate traffic stop at London Airport at a frequency of from two to seven services weekly during the season from May to October inclusive, for a period of ten years, commencing May 1st, 1955.

APPLICATION No. 353. For a U.K. Internal Service, with Dakota aircraft for the carriage of passengers and supplementary freight between Liverpool and London Airport at a frequency of from two to seven services weekly during the period from October 1st, 1954 to September 30th, 1964.

APPLICATION No. 354. From Cambrian Air Services, Ltd., of Cardiff (Rhoose) Airport, Barry, Glamorgan. For a Seasonal Normal Scheduled Service, with D.H. Dove and D.H. 89 aircraft for the carriage of passengers and supplementary freight between Guernsey and Dinard at a frequency of three services weekly increasing according to traffic demand during the season from May to September inclusive for a period of ten years, commencing May 7th, 1955.

APPLICATION No. 28/1. From Cambrian Air Services, Ltd., of Cardiff (Rhoose) Airport, Barry, Glamorgan. For permission to include traffic stops at

(*Continued on col.* 1 *page* 77)

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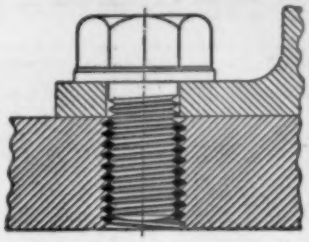

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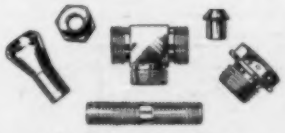

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PUBLIC ANNOUNCEMENTS

(*Continued from foot of col. 2 page 76*)

Bristol and Guernsey on their Normal Scheduled Service between Cardiff and Dinard which has been conditionally approved by the Minister of Transport and Civil Aviation, for operation during the period up to September 30th, 1962.

APPLICATION No. 12/1. From Morton Air Services, Ltd., of Croydon Airport, Surrey. For permission to change the frequency on their Seasonal U.K. Internal Service on the route London (Croydon)-Jersey/Guernsey (Application No. 12) which has been approved for operation on Fridays and Saturdays only between mid-June and mid-September by the Minister of Transport and Civil Aviation from two return flights on Fridays and six return flights on Saturdays, to two return flights on Fridays, four return flights on Saturdays and two return flights on Sundays.

APPLICATION No. 54/1. From Olley Air Service, Ltd., of Croydon Airport, Surrey. For permission to change the frequency on their Seasonal U.K. Internal Services on the routes London (Croydon)-Jersey and London (Croydon)-Guernsey (Applications Nos. 54 and 55), which have been approved for operation on Fridays and Saturdays only between mid-June and mid-September, by the Minister of Transport and Civil Aviation, from two return flights on Fridays and six return flights on Saturdays to Jersey and two return flights on Fridays and four return flights on Saturdays to Guernsey, to two return flights on Fridays, four return flights on Saturdays and two return flights on Sundays to Jersey, and two return flights on Fridays, three return flights on Saturdays, and one return flight on Sunday, to Guernsey.

APPLICATION No. 324 (Amended). From B.K.S. Air Transport Ltd., of Dorset House, Old Burlington Street, London, W.1. For a Seasonal Normal Scheduled Service with Dakota aircraft for the carriage of passengers, supplementary freight and mail between Newcastle and/or West Hartlepool and Knocke Le Zoute and/or Ostend with an optional intermediate traffic stop at Leeds (Yeadon) when available, at a frequency of from one to 14 services weekly during the season from April to October inclusive, for a period of seven years, commencing May 1st, 1955.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30th, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, Westminster, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [2551

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INDEX TO ADVERTISERS

	Page
Abbey Panel and Sheet Metal Co., Ltd.	52
Aeronautical Radio Services, Ltd.	74
Air Charter, Ltd.	79
Air Industrial Developments, Ltd.	3
Airflow Streamlines, Ltd.	Cover ii
Alvis, Ltd.	31
Armstrong Siddeley Motors, Ltd.	50
Armstrong Whitworth Aircraft, Ltd., Sir W. G.	30
Aviation Traders, Ltd.	28, 29
B.B. Chemical Co., Ltd.	43
Boulton Paul Aircraft, Ltd.	15
Bramah and Co., Ltd., J. R.	26
Bristol Aeroplane Co., Ltd., The	Cover iv
British Air Line Pilots' Association, Ltd.	78
British Ermeto Corporation, Ltd.	64
British Emulsifiers, Ltd.	64
British Insulated Callender's Cables, Ltd.	11
British Messier, Ltd.	33
British Thomson-Houston Co., Ltd., The	58
Brooklands Aviation, Ltd.	78
Burnley Aircraft Products, Ltd.	46
Canadian Car and Foundry Co., Ltd.	23
Cassell and Co., Ltd.	62
Cellon, Ltd.	12
Central Office of Information (R.A.F.)	54
Chain Belt Co.	62
Chinn and Co., Ltd., J. S.	65
Chloride Batteries, Ltd.	16
Corner and Co., Ltd., G.	71
Cross Manufacturing Co. (1938), Ltd.	76, 78
Curd Components, Ltd.	76
Decca Radar, Ltd.	27
De Havilland Aircraft Co., Ltd., The	38
Dragonair, Ltd.	72
Eagle Aircraft Services, Ltd.	76
Ekco Electronics, Ltd.	46
Elliott Equipment, Ltd.	19
English Electric Co., Ltd., The	33, 53, 77
E.R.S., Ltd.	65
Fairey Aviation Co., Ltd., The	37
Feltham and Son, Ltd., Walter H.	78
Field Aircraft Services, Ltd.	75
Fireproof Tanks, Ltd.	63
Fishers	76
Flight Equipment and Engineering, Ltd.	66
Flight Refuelling, Ltd.	44
Fokker Aircraft	45
Folland Aircraft, Ltd.	32
Fox and Sons (Aviation), Ltd.	76
Frankenstein and Sons (Manchester), Ltd., P.	22
General Electric Co., Ltd., The	7
Gillott and Sons, Joseph	14
Gloster Aircraft Co., Ltd.	80
G.Q. Parachute Co., Ltd.	20
Habershon and Sons, Ltd., J. J.	60
Headquarter and General Supplies, Ltd.	78
Hepworth and Grandage, Ltd.	59
Hobson, Ltd., H. M.	25
Hordern-Richmond (Sales), Ltd.	6
Hulton Press, Ltd.	55
Hunting Percival Aircraft, Ltd.	80
Hymatic Engineering, Co., Ltd., The	13, 79
Integral, Ltd.	60
Jet Tanks, Ltd.	64
Kenton Equipment, Ltd.	68
Kigass, Ltd.	2
Lewis, Ltd., D.	74
Lodge Plugs, Ltd.	41
Lucas (Gas Turbine Equipment), Ltd., Joseph	Cover iii
Marshalls Flying School, Ltd.	79
Marston Excelsior, Ltd.	73
Martin-Baker Aircraft, Ltd.	39
M. H. H. Engineering Co., Ltd.	69
M. L. Aviation Co., Ltd.	77
Mollart Engineering Co., Ltd.	71
Mullard, Ltd.	10
Murex Welding Processes, Ltd.	56
Myers Co., Ltd., Wayne V.	57
Napier and Sons, Ltd., D.	48, 49
New Welbeck, Ltd.	72
Opperman, Ltd., S. E.	66
Park, Ltd., R. and J.	72
Partridge Wilson and Co., Ltd.	51
Peto and Radford	4
Powis and Sons, Ltd., David	66
Pullin and Co., Ltd., R. B.	70
Pulsometer Engineering Co., Ltd.	67
Reed, Ltd., Austin	44
Regent, Ltd., L. K.	74
Rists Wires and Cables, Ltd.	67
Rolls-Royce, Ltd.	Cover i
Rotax, Ltd.	36
Rozalex, Ltd.	74
Rubbaglass, Ltd.	72
Saunders-Roe, Ltd.	40
Scottish Aviation, Ltd.	8
Shell-Mex and B.P., Ltd.	34
Short Brothers and Harland, Ltd.	5
Siebe, Gorman and Co., Ltd.	70
Siegrist-Orel, Ltd.	68
Standard Telephones and Cables, Ltd.	9
State Express Cigarettes	17
Staravia	77
Teddington Controls, Ltd.	68
Teleflex Products, Ltd.	62
Thermo-Plastics, Ltd.	56
Tungum Co., Ltd., The	69
Ultra Electric, Ltd.	42
Valay Industries, Ltd.	24
Vernons Industries, Ltd.	61
Vickers-Armstrongs, Ltd.	47
Vosper, Ltd.	63
Westland Aircraft, Ltd.	1
Westway Models, Ltd.	58
Weyburn Engineering Co., Ltd.	70
Whyte and Collins, Ltd.	78
Wiggin and Co., Ltd., Henry	21
Wilkinson Rubber Linatex, Ltd.	18
Wilson and Sons (London), Ltd., W.	73

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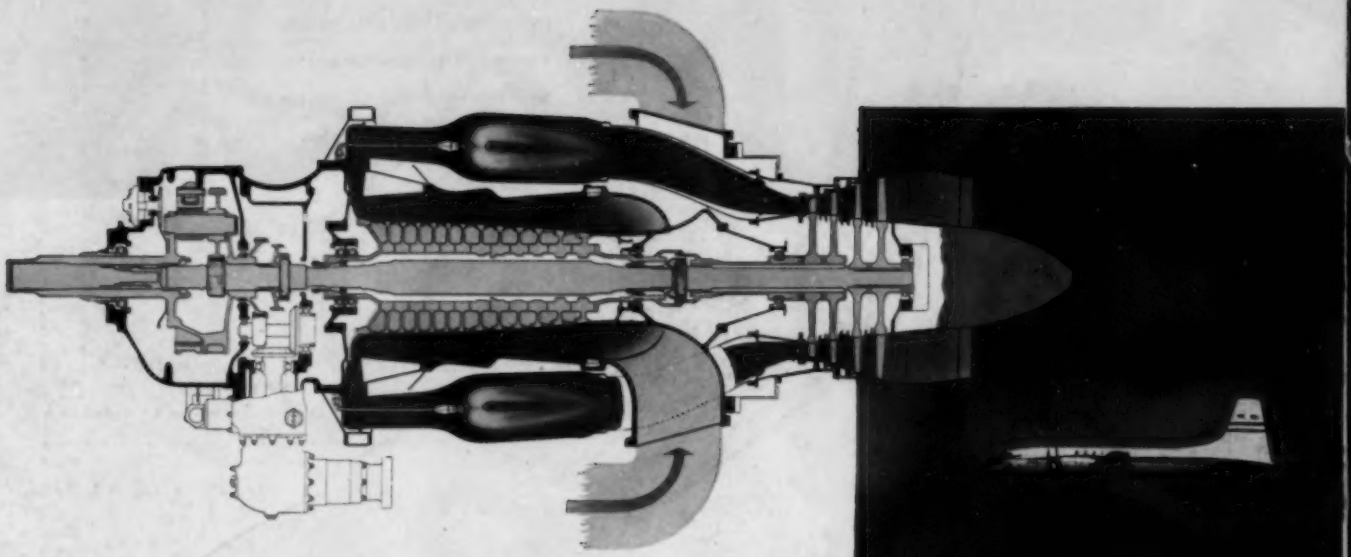

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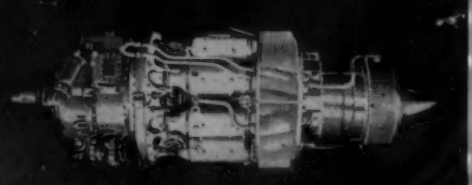

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